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THE

LONDON ENCYCLOPÆDIA.

VOL. XIV.

MEDICINE TO MITHRIDATES.

THE

LONDON ENCYCLOPÆDIA,

OR

UNIVERSAL DICTIONARY

OF

SCIENCE, ART, LITERATURE, AND PRACTICAL MECHANICS,

COMPRISING A

POPULAR VIEW OF THE PRESENT STATE OF KNOWLEDGE.

ILLUSTRATED BY

NUMEROUS ENGRAVINGS, A GENERAL ATLAS,

AND APPROPRIATE DIAGRAMS.

Sic oportet ad librum, presertim miscellanei generis, legendum accedere lectorem, ut solet ad convivium conviva civilis. Convivator annititur omnibus satisfacere; et tamen si quid apponitur, quod hujus aut illius palato non respondeat, et hic et ille urbane dissimulant, et alia fercula probant, ne quid contristent convivatorem. *Erasmus.*

A reader should sit down to a book, especially of the miscellaneous kind, as a well-behaved visitor does to a banquet. The master of the feast exerts himself to satisfy his guests; but if, after all his care and pains, something should appear on the table that does not suit this or that person's taste, they politely pass it over without notice, and commend other dishes, that they may not distress a kind host. *Translation.*

BY THE ORIGINAL EDITOR OF THE ENCYCLOPÆDIA METROPOLITANA,

ASSISTED BY EMINENT PROFESSIONAL AND OTHER GENTLEMEN.

IN TWENTY-TWO VOLUMES.

VOL. XIV.

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THE

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MEDICINE.

MED'ICAL, *adj.*
MED'ICALLY, *adv.*
MEDIC'AMENT, *n. s.*
MEDICAMEN'TAL, *adj.*
MEDICAMEN'TALLY, *adv.*
MED'ICATE, *v. a.*
MEDICA'TION, *n. s.*
MEDIC'INABLE, *adj.*
MEDIC'INAL,
MEDIC'INALLY, *adv.*
MED'ICINE, *n. s.* & *v. a.*

Lat. *medicus, medicina*; Fr. *medecine*. Physical, or relating to the healing art. Medicament is any thing used in that art; a topical application. To medicate, to tincture or impregnate with medicine or any thing of a medicinal nature. Medicinable and medicinal, having the power of healing, or of physic; appertaining to physic. Medicine is physic; any remedy prescribed by the faculty: the verb is obsolete, but used by Shakspeare as signifying to operate upon as physic.

A merry heart doeth good like a *medicine*; but a broken spirit drieth the bones. *Prov.* xvii. 22.

O, my dear father! restauration, hang
Thy *medicine* on my lips; and let this kiss
Repair those violent harms.
Shakspeare. King Lear.

Not all the drowsy syrups of the world
Shall ever *medicine* thee to that sweet sleep
Which thou owedst yesterday. *Shakspeare.*

Come with swords as *medicinal* as true,
Honest as either; to purge him of that humour
That presses him from sleep. *Id. Winter's Tale.*

Every *medicine* is an innovation, and he that will not apply new remedies must expect new evils; for time is the greatest innovator; and if time of course alter things to the worse, and wisdom and counsel shall not alter them to the better, what shall be the end? *Lord Bacon.*

The watering of the plant with an infusion of the *medicine* may have more force than the rest, because the *medication* is oft renewed. *Id.*

Accept a bottle made of a serpentine stone, which gives any wine infused therein for four and twenty hours the taste and operation of the spa water, and is very *medicinable* for the cure of the spleen. *Wotton.*

Admonitions, fraternal or paternal, then public reprehensions; and, upon the unsuccessfulness of these milder *medicaments*, the use of stronger physick, the censures. *Hammond.*

Thoughts my tormentors, armed with deadly stings,
Mangle my apprehensive tenderest parts;
Exasperate, exulcerate, and raise
Dire inflammation, which no cooling herb
Nor *medicinal* liquor can assuage. *Milton.*

The fumes, steams, and stenches of London, do so *medicate* and impregnate the air about it, that it becomes capable of little more. *Graunt.*

Innumerable persons blind, deaf, dumb, lame, and maimed, he restored to the use of their faculties, and members respectively, without any *medicinal* applications, or any natural means conducible to those purposes. *Barrow.*

Learned he was in *medicinal* lore,
For by his side a pouch he wore,
Replete with strange hermetick powder
That wounds nine miles point-blank with solder.
Butler.

In this work attempts will exceed performances, it being composed by snatches of time, as *medical* vacation would permit. *Browne's Vulgar Errours.*

That which promoted this consideration, and *medically* advanced the same, was the doctrine of Hippocrates. *Id.*

He advises to observe the equinoxes and solstices, and to decline *medication* ten days before and after. *Id.*

The substance of gold is invincible by the powerfullest action of natural heat; and that not only alimentally in a substantial mutation, but also *medicamentally* in any corporeal conversion. *Id.*

The hearts and galls of pikes are *medicinable*. *Walton.*

A cruel wound was cured by scalding *medicaments*, after it was putrified; and the violent swelling and bruise of another was taken away by scalding it with milk. *Temple's Miscellany.*

I wish to die, yet dare not death endure;
Detest the *medicine*, yet desire the cure. *Dryden.*

The second causes took the swift command
The *medicinal* head, the ready hand;
All but eternal doom was conquered by their art.
Id.

Such are called *medicinal*-days by some writers wherein no crisis or change is expected, so as to forbid the use of medicines; but it is most properly used for those days wherein purging, or any other evacuation, is more conveniently complied with. *Quincy.*

To this may be ascribed the great effects of *medicated* waters. *Arbuthnot.*

No present health can health ensure
For yet an hour to come;
No *medicine*, though it oft can cure,
Can always balk the tomb. *Cowper.*

1. MEDICINE, from Lat. medico, to heal, in its verbal signification, means, as we have seen, the art of curing, mitigating, and preventing disease; as a substantive it signifies the material employed to effect these purposes.

2. In treating of this subject, as a science and an art, we shall first present our readers with an historical account of the successive revolutions which medicine has undergone from the earliest periods; we shall then give a short estimate of its present condition; engage in the consideration of classifying or arranging disease; and finally treat of ailments as they occur in practice, enquiring into their sources remote and immediate, and the methods best adapted to remedy and remove them.

PART I.

HISTORY OF MEDICINE.

3. To reason from the general course of nature, says an author of whose labors we shall avail ourselves in the present article, it is evident that man, subjected as he is to the influence of a variety of causes which may disorder the action of his organs, must very soon have been obliged to seek for the means of alleviating the pains and of curing the diseases with which he was affected. As he cannot seclude himself entirely from the constant agency of many of those external causes; and as he carries within him several others which are destined to act at particular periods of life, or which may at any time exert their influence; we may with safety affirm that the first trials of particular remedies bear almost as ancient a date as the existence of man himself. Among the most rude and uncultivated tribes, as those of New Holland, and New Zealand, of Lapland, and Greenland, of North America and the interior of Africa, we find traces of the practice of medicine and surgery. The savages in these countries know how to distinguish different diseases, and to apply a more or less suitable method of treatment; and they are acquainted with the use of several remedies which form no part of their daily food. These uncivilised communities present to us the picture of mankind in their infancy, and give us a lively idea of the original state of all nations.

4. From their first existence, men must have had diseases which they naturally sought to cure or alleviate. To attain these objects they tried a variety of methods. But we may presume that their discoveries were in general very slow, and more frequently the offspring of fortunate accidents than the result of rational investigation. Men receiving by tradition a knowledge of the discoveries which had been already made, would soon find themselves obliged to make new observations for themselves, and in this manner their acquisitions would gradually increase. In these early ages all the knowledge of the tribe formed a common stock; and their imperfect arts might be exercised by all those who were endowed with a certain portion of intelligence. Medicine therefore existed before there were any regular physicians. (Cabanis).

5. Whether instinct or actual observation had most to do with the origin of medicinal attempts has been the subject of dispute, but it is most probable that each had a share in the matter; and, although we must receive as fabulous and unworthy of full credence several accounts which have been transmitted to us on the subject of men being taught the virtues of herbs by witnessing the instinct of brutes, it is more than probable that some of these narrations have their foundation in truth.

6. The necessity of medicine from the earliest periods being admitted, says Le Clerc, it may naturally enough be inferred, that both reason and chance might place several remedies in the hands of man; and the most ancient accounts we find extant, respecting the manner in which medicinal virtues were ascertained to exist in certain plants, attribute the discovery of such virtues to accidental observation. We learn from fabulous history that Glaucus, son of Minos king of Crete, having fallen into a cask of honey, was sought for some time unsuccessfully, until Polydius, a soothsayer, who came from Argos, discovered where he was immured. Minos finding this Polydius to be so cunning a personage, believed that it was in his power, if he were put upon his mettle, to restore the young Glaucus to life, and accordingly ordered him to be shut up in the same cask with the dead body for the purpose of inducing him to make the experiment of re-animation. While thus confined with the corpse, and finding himself without resource, he perceived a serpent approaching him which he immediately killed; soon after another serpent came; and, regarding the dead body of the first, immediately went out, and returned forthwith bearing a certain herb with which he covered the dead body of his fellow, and thereby restored the animal to life. Polydius directly tried the same experiment on the dead body of Glaucus, and with the same effect.

7. This well known story, taken from Hyginus and Apollodorus, Le Clerc follows up by another, which, as having in it a little less of the marvellous, is of course entitled to a little more credit. Melampus while performing the duties of a shepherd, having observed that his goats were purged while they fed on hellebore, ordered the milk of these goats to be administered to the daughters of Prœtus, who imagined themselves transformed into cows; the milk proved purgative to them, and they were cured by it of their hallucination; and hence has been traced the origin of an opinion which came to be general, that hellebore was not merely a cathartic but that it possessed some specific influence upon disorders of the mind.

8. In another part of his history Le Clerc alludes to the story told by Pliny respecting the hippopotamus, or sea-horse, drawing blood from his body by means of a reed, thus relieving himself from a plethora, and thus teaching man the art and benefit of artificial blood-letting; and to the account further of the bird ibis administering enemas to itself with its own bill; and having recorded these with other narratives and intimations, he concludes with the following judicious remarks. Besides that fable is more or less founded on fact, every one knows by his own observation on others that the condition of health is greatly referrible to matters whether of diet or luxury taken out of the ordinary course of things; and, if accidental observation be thus capable of teaching the deleterious qualities of certain substances, the same observation would be likely to lead to the discovery of salubrious substances. Thus mankind would come successively to observe, to reason, and to generalise, and thus would experience and experiment in the art of healing be gradually systematised into a science.

9. We may here incidentally remark, before we proceed with our history, that the simplicity of primeval medicine, and its present condition among savage tribes, have been preferred as arguments against the necessity of its complication; in other words it has been urged that the ancients with their herbs and simples did quite

as well as the moderns who have brought into subserviency the other kingdoms of nature, and have converted medicine from a matter of mere observation and simple inference, into one of extensive reasoning and complicated induction; but objectors of this kind, even if we allow their correctness as to fact, overlook the circumstance of artificial states engendering artificial wants, and that as law, from a simple consideration of right and wrong, branches eventually out into code, and precepts, and acts, so does the necessity of medicine's complication increase with increasing luxury, and become complicated to meet the complicated demands of artificial existence.

10. As, however, medicine was first 'cultivated by the patients themselves, or by their friends and relations, it becomes a matter of interesting investigation to trace the successive steps by which it proceeded from general to particular cultivation; and to develope the causes and circumstances which have in the course of ages advanced the science and profession to the rank and importance which they now assume and maintain.

11. It must be recollected, as a matter of importance connected with this enquiry, that in the very earliest ages, and before the physical sciences had made much progress, events were often considered as having received a satisfactory solution, in respect to their rationale, by referring them to divine interpositions; no one, indeed, even in the present day, ought for a moment to question that an interposing providence regulates the affairs of the world, but we do not now talk of 'the darts of Apollo' when we contemplate the consequences of a heated atmosphere on the Trojan marshes. But, when such was the mode of settling the matter, it is easy enough to conceive that the first men, who came as a distinct order of men to take cognizance of disease and its management, would be those who were the professed media of communication between heaven and earth.

12. 'The priests,' says Cabanis, 'soon seized upon the province of medicine, and found it no difficult matter to combine it with their other instruments of power. Indeed, the medical and the sacerdotal professions have in reality many features of resemblance. Both bring into action the same principles, hope and fear; and, although the objects of these two passions are not the same in the hands of the priest as in the hands of the physician, their effects had, at that time, nearly the same degree of influence in promoting the views of both. Certain it is that medicine, like superstition, exerts on the minds of men an influence proportional to their weakness; and, as the former acts upon more real and palpable objects than the latter, it is found that the most rational and enlightened men can never entirely resist its power. In short, no art penetrates further into the human heart; no profession enables its votaries more easily to obtain possession of the most important family secrets; no species of doctrine (except that, indeed, which relates to the agency of invisible powers) affects so nearly all those fanciful ideas in which the human mind, when it throws off the restraint of reality, is so apt to indulge; and certainly none furnishes means more independent of all political revolution, to those who impose upon the credulity of the public, and cultivate it, like a fruitful soil, with the utmost care and attention. It was, therefore, natural that the priests should become physicians, as they in fact became; and in most savage tribes the art is still practised by the priests or by mountebanks.

13. Egypt was the cradle of medicine as it appears to have been of every other science; and we hear of Thoth, or Thouth, whom the Greeks have called Hermes, and the Latins Mercury, but about whose actual existence there seems to be some doubt: and the same may be said of Isis and Osiris, which were perhaps rather regal titles and allegorical representations than real existences. At any rate, their history is so mixed up with fable, and one is in such a manner confounded with the other, that very little of satisfaction can be obtained with respect to them as cultivators and promoters of the healing art. Some have attributed the invention of medicine to Horus, son of Isis, who was the Apollo of the Greeks, and about whom the early historians speak as a real person. It is to this Apollo that Ovid alludes in his Metamorphoses, making him call himself the inventor of medicine and the subjector of plants to his power in the following well-known lines:—

Inventum medicina meum est, opiferque per orbem
Dicor, et herbarum subjecta potentia nobis, i. 521.

14. Æsculapius was called by the Greeks the son of Apollo, and we find a great deal, both in the historians and poets of the early periods, of allegorical and metaphorical matter mixed up with the accounts respecting the circumstances of Æsculapius's birth and elevation. Certain it is, that, for a long time, he acquired the ascendancy over medicine and medical rites; and the priests, who were still the physicians of the time, acted in the assumed capacity of priests of Æsculapius, and invented charms and effected cures avowedly under this assumption.

15. Temples were erected in different parts of Greece, dedicated to Æsculapius, now deified, and from these temples oracles were issued by the officiating priest, as if emanating from the resident and presiding divinity; these oracular emanations were usually conceived and issued in such sort as to establish their prophetic and operative power in the event of success, and to be susceptible of a double signification, so as to elude exposure, or conceal the imposition, in the event of the prediction not being fulfilled. And in spite of the doubts of the philosophers, and the occasional ridicule of the satirical writers of the times, the mass of the people resorted to the Æsculapian temples under the full feeling of belief and expectation; and often returned, satisfied and cured, from the very circumstance of their faith keeping pace with their wishes.

16. We are told, moreover, that the air respired in the country, and surrounding the Æsculapian temples, was naturally pure, from the elevation of the soil, and was rendered still more salubrious by the woods which encompassed them. These woods themselves became also the objects of religious veneration; they were preserved with great care; and their sombre shade

[illegible] the [illegible] their [illegible] [illegible] en-[illegible] which seemed to be more [illegible] to them. For an [illegible] would have been very insufficient [illegible] his advice did not [illegible] it was at least becoming that the patients should [illegible] In consequence [illegible] this [illegible] must have been accomplished by [illegible] which the patients experienced in [illegible] in the temples; by an [illegible] they had been but [illegible] consequences [illegible] effects [illegible] produces upon man, [illegible] upon the generality of animals; and [illegible] effects of [illegible] a certain descrip-[illegible] who possess more cunning [illegible] himself in [illegible] influence of which left [illegible] and he maintained [illegible] better, [illegible] less [illegible]

17. The temples of Æsculapius, continues the author from whom we are now extracting, were very spacious, and within their walls were convenient lodgings for the priests; but, as the deity did not permit any person to die within them, which certainly would have been very inconvenient, those persons who were afflicted with severe disorders, and women in the last stages of pregnancy, were obliged to remove to the neighbourhood, and they often remained in the open field, exposed to all the injuries of the weather. The deity also forbade any part of the offerings and sacrifices to be consumed out of the temples. From this regulation, which was no doubt, very politic, we see that he was both wise and provident, and had the welfare of his ministers no less at heart than his own fame and character.

18. Of the great number of temples dedicated to Æsculapius the most celebrated were those of Epidaurus, of Pergamus, of Cos, and of Cnidos. The temple of Cos was burnt in Hippocrates' time. The walls and pillars of it were covered with inscriptions, briefly describing the history of diseases, and giving an account of the remedies which had been successfully employed for their cure according to the advice of the deity. People of affluence had these inscriptions engraved on marble, on metal, or on stone; the poorer sort had them carved on mere tables of wood. However imperfect these descriptions of diseases, and of the methods of cure, may have been, their collection was nevertheless very valuable. They formed, as it were, the first rudiments of the art; and discovered some faint traces of the method of observation and experiment which alone is capable of placing it on a solid basis.

19. In contemplating the circumstances and particulars connected with and characterising ancient medicine, we are disposed to think that the whole was imposition on the part of the agents, and credulity on the part of the people; but it may be questioned whether the Æscula-pian [illegible] and priests did not act as much under the influence of self-deception as that of deceiving the multitude; and, indeed, when they found crowds of votaries returning from their visits to the temples, with their faith confirmed and their maladies healed, it was natural enough, in these early times of fanaticism and unbounded belief, that they should come to believe themselves what the people supposed them to be, immediate interposers between them and deity. Knavery is often supposed and charged, even in modern times, when the fact has been that the individuals thus charged have been acting under the influence of somewhat better motives than those supposed to be in operation. The facts connected with the history of our late prophetess, Joanna Southcott, were sufficiently humiliating and extraordinary; but it is far from impossible that even this woman was quite as much a fanatic as an impostor, and that she was worked upon by the faith of her followers, so as to actually suppose herself what her disciples gave her credit for being. In any other point of view than that of fanaticism and delusion, it is difficult to realize the systematic procedure of the priests in ancient times with regard to their profession of miraculous powers.

20. In Egypt then, in the first instance, and subsequently in Greece, medicine was practised alone by the sacerdotal orders; and this was in fact the case among the Israelites; we find in sacred history that the Levites were the persons consulted respecting the management of leprosy and other disorders incident to the age and people, and in the porch of the temple of Jerusalem a complete formulary of remedies was exhibited, of which Solomon was said to be the author.' The Essenes, a sect celebrated for the pure and mild system of morality which they endeavoured to propagate among a wicked and hypocritical people, cultivated the science of medicine, not only in order to render themselves more respected, but also in order to discover means to improve the minds of their adherents by rendering their bodies more healthy. Zealous apostles of their doctrine they endeavoured to confirm it by the performance of cures; and by these means they were often enabled to brave the jealous furies of the Pharisees, those hypocritical and domineering priests. They went sometimes by the name of Essenes and sometimes by the appellation of Θεραπευται, which signifies healers or physicians.'

21. Chinese pretensions to antiquity always defy any attempts to follow them; but there were some practices among these people of exceedingly ancient date which have been resumed in modern times such as acu-punctuation; and among the Babylonians and Chaldeans a great deal of their medicine was connected with astronomical investigations that characterised these people. Herodotus, however, speaks of the sick at Babylon as being exposed in public places to the inspection of passers by, who were solicited to give them advice and furnish them with means of cure; so that part of the medicine of these ancient people consisted in something more palpable than astrological influence, or mere calculations from planetary positions.

22. From the hands of the priests, medicine fell into those of the philosophers. Certain men, of a noble character and more sound understanding, soon began to direct their attention to the study of the rising arts. At first they employed themselves with those which related to their immediate wants. The science of public and private morals was doubtless regarded by them as belonging to this class; and accordingly we see them employing their utmost sagacity in the research of its rules, exerting the strength of their judgment in their delineation, and inculcating with all the commanding powers of their eloquence the advantages which accrue, both to individuals and society in general, from a rational but entire obedience to those immutable laws. Natural philosophy, astronomy, and geometry, which sciences were all in their infancy, became at the same time the objects of their contemplation. From this investigation, superficial as it no doubt was, of the different classes of natural phenomena, they acquired the habit of a certain method in their proceedings, which soon became a sort of necessary want to them.

23. When these sages afterwards came to turn their attention to medicine they were able to throw a new light upon the science. Accustomed as they had been to arrange in a certain order the different branches of their knowledge, to trace relations between them, and to connect them together, they perceived how requisite it was to class the indigested mass of medical observations, before they could be subjected with advantage to the test of reasoning. And if, on the one hand, in order to discover some connecting principle among so great a number of facts, it was absolutely necessary to resort to classification; on the other hand it was no less requisite to impress the conclusions which were obtained firmly on the memory, to arrange them, and to express them in the form of general rules.

24. The revolution which these early philosophers effected in the medical art was evidently a work of necessity. The time was come for drawing it forth from the recesses of the temples, and for dissipating at least in part the obscurity in which ignorance and quackery had involved it. If these attempts had done nothing more than bring it fairly to light, they would still have the merit of greatly contributing to its progress. From that time forward, a rational system was substituted in the place of undigested collections of rules; enterprising geniuses began to connect the principles of the science with those of the other branches of human knowledge; and its intimate relation to the different parts of natural and moral philosophy became every day more apparent to minds, whom books could not yet mislead from the path of pure observation.

25. These philosophers then freed medicine from its superstitious and hypocritical character. They transformed an occult and sacerdotal doctrine into a popular science and a common art. This reform was of infinite service both to medicine and philosophy; but it must be confessed that its happy effects were in some degree combined with serious disadvantages. For, in remedying errors, the reformers often fell into a dangerous extreme; not satisfied with applying to medicine that general and sublime species of philosophy which presides over all the sciences, and which alone is capable of illustrating their principles and operations, they vainly attempted to transfer to it the imaginary laws of their systems of natural philosophy, and various other conjectures which were the most fertile sources of error when thus applied, that the particular objects to which they related had absolutely no connexion with the living system.

26. Thus Pythagoras endeavoured to explain the laws of the animal economy, the formation of diseases, the order of their symptoms, and the action of medicine by the power of numbers Democritus again referred them to the motions and different relations of figure and position of the primary atoms of matter, while Heraclitus attempted to account for them by the various modifications of which the ovative and preservative fire of the universe is susceptible. It was but natural that the hypothesis which each of them employed for illustrating the production of animated bodies should be also applied by him to explain the series of phenomena brought to view by their spontaneous evolutions, by the agency of external substances, by the changes of which they are susceptible, and by their final destruction, or that alteration of form which we call their death. Hence arose so many futile theories of which we may find examples in the works of Plato, Aristotle, and Plutarch, and from which the writings of Hippocrates himself are not wholly exempt. Empedocles, for example, the disciple of Pythagoras, affirmed that the muscular flesh was composed of the four elements combined in equal proportions; he supposed the nerves when cooled by the external air to form the nails; he thought the perspirable matter and tears resulted from the fusion of the blood, and imagined the osseous matter of the system to proceed from the union of earth and water. Timæus of Locris framed a new system of cosmogony, from which he deduced his physiological views and methods of cure. Eudoxus, Epicharmus, Democedes, &c., adopted the opinions of the Italian school founded by Pythagoras, and their system of physic was supported and guided by that philosopher so celebrated, and yet so little understood, even by the ancients; but for which, when we consider its beneficial effects in a moral and political point of view, it is impossible not to be inspired with sentiments of veneration.

27. To conclude: all men of letters, whom a sedentary life and the nature of their labors disposed to melancholy habits, cultivated medicine as a subject of meditation upon themselves. Their habitual valetudinary state obliging them often to invoke its assistance, they had the additional motive of the proper care and preservation of their own health to invite them to the study. Their first acquirements, superficial as they often were, could not fail to prove in active minds the germs of numerous errors. Those among them who did not combine the observation of diseases with their theoretical opinions, such as they had been delivered in the schools by oral communication, or detailed in the small number of written works which existed in those

early times, allowed themselves to be easily deluded by romantic notions; and the custom of ranging and systematising all their ideas rendered their errors more serious and dangerous.

28. Of all the philosophers, who at that time devoted themselves to the study of medicine, no one preserved himself more free from the spirit of hypothesis than Acron of Agrigentum in Sicily. This bold and original genius, whom the empirics of later times have regarded as their chief, was desirous to refer the art of medicine to experience alone. Accordingly, he reduced all the reasonings about disease to the appreciation of the different symptoms which admitted of comparison, and to the discovery of analogies from which he observed that we may often draw the indications of cure. But, although he enjoyed a high reputation in his life time, his opinions could not overcome the ascendancy of more positive and dogmatical theories; and it was not till long after that they became the rallying point of a sect of respectable physicians. Although, too, these opinions were less dangerous when applied to practice than those of his opponents, it is but too certain that a spirit of rivalship carried the adherents of both almost equally far beyond the bounds of reason, which indeed would have easily reconciled them, for the dispute turned, properly speaking, upon mere words.

29. The philosophers of antiquity then both improved and injured the science of medicine. They rescued it from undiscerning ignorance, but they precipitated it into a variety of hazardous conjectures; they delivered it over from the blindness of empiricism to all the rashness of dogmatism. In short, its lot was the same as that of moral philosophy. Medicine at first, as placed in the hands of the poets, exhibited only an assemblage of beautiful images or refined sentiments; while, in the hands of the priests, it adopted the vague language and mysterious tone of superstition; and, in the hands of those primitive philosophers whose exertions in other respects claim our warmest acknowledgments, its scattered, confused, and undigested materials were combined and formed into more or less regular, and more or less perfect systems; but it usurped the principles of many other sciences which were themselves but in a crude state; it shared in their errors, which proved the more injurious to it, as these sciences had for the most part little connexion with it. We may even venture to assert, that it made in some measure the complete round of the false systems which prevailed in the different branches of human knowledge, and which succeeded each other by turns (Cabanis).

30. We have made this long extract from a modern author, because we think that he has in a happy manner, traced the circumstances of directing the succession of medicine from that of being a symbolical and poetical matter in the first instance, and afterwards a sacerdotal concern, into the hands of those men who were named philosophers in consequence of their seeking to divine the causes of things, and looking deeper than the vulgar into the principles of material phenomena.

31. But philosophers full of desire to penetrate into the secrets of nature, and engaged in investigations on the subject of abstract truth, were likely enough to prove bad physicians on two grounds. In the first place they could not be supposed to have time or disposition to attend minutely to those details which practical medicine demands; and in the next it is in the very nature of philosophical speculation to force analogies into the mind that are of the most fallacious nature. Medicine, then, first in the hands of poets and priests, and subsequently cultivated by men of general science, awaited the birth of a superior mind who should as it were stamp a peculiarity on its pretensions, and learn, and teach, and practise it as a distinct and separate branch of pursuit.

32. It was this which the far famed Hippocrates did for the science and art of healing, and on this account he has been styled the father and founder of medicine. Hippocrates was a philosopher before he was a physician; but finding, says Le Clerc, that the speculations of natural science were not so likely to benefit society as the practice of medicine, he only retained enough of his first pursuits to enable him to reason justly on the subject of medicine, which he at length made his principal or rather his only study. The original of our quotation runs thus: 'Mais ne jugeant pas que les speculations de cette derniere science (philosophie) fussent aussi utiles a la societé que la pratique de la premiere, il ne retint de la philosophie qu'autant qu'il en fallait pour raisonner justement dans la medicine, dout il fit sa principale, ou plutot son unique etude.'

33. Cabanis expresses the same fact in a more diffuse but in a pleasing and instructive manner. We employ in this instance the translated copy of the French author by Dr. Henderson. Surrounded from his infancy with all the objects of his studies; instructed in eloquence and philosophy by the most celebrated masters; having his mind enriched with the largest collection of observations which could at that time have existed; and endowed in fine by nature with a genius which was at once penetrating and comprehensive, bold, and prudent; he commenced his career under the most favorable auspices, and pursued it during a period of more than eighty years, with that degree of renown which was equally due to his talents and to the greatness of his virtuous character.

34. Euryphion had just published the Cnidian Sentences. Herodicus too by the revival of gymnastic medicine, the original invention of which was ascribed to Æsculapius, had given to the art a more regular and scientific form. They knew how to observe diseases, and were acquainted with the most general remedies, such as venæsections, emetics, cathartics, and bathing, the use of incisory instruments, and of the actual cautery or fire; and although a certain routine, numerous false theories, and the influence of superstition, continued to deform the prevailing methods of treatment, yet the glimpses of a happier dawn were perceived at intervals in almost all the branches of medicine.

35. It was in these fortunate circumstances that Hippocrates appeared as it were on a sudden, and procured to the Coan school a lasting pre-eminence to which it was doubtless well entitled, since it had been able to produce such rare talents. Amid the sports of childhood he received from the mouth of his parents the elementary notions of medical science; by viewing diseases he learned to distinguish them; by witnessing the preparations and employment of medicines, their use and their virtues became equally familiar to him. The first objects which strike the young and curious senses, the first comparisons which they suggest to the infant mind, the first judgments of growing reason, have a greater influence on the remaining part of life, as the traces which they leave, and the habits which they form, are for the most part indelible. It is then that the bent of the character, and the particular cast or direction of the operations of the mind, are determined. To the fatal disposition to satisfy ourselves with words, and to affix to those we employ erroneous or vague ideas of the things they were meant to express, may perhaps in a great measure be ascribed the custom of constantly figuring to ourselves objects which we have never seen, and of substituting the fictions of the imagination for the works of reality. A sound habit of judgment depends upon the justness and accuracy of the sensations; and the organs which are designed for the reception of the latter require culture, that is, a well directed employment. Now as nature or the objects surrounding us are our proper teachers, and as their instructions differ from those of men or books in this respect that they are always adapted to our faculties, they are consequently the only ones which are seldom or never fruitless, and the only ones which never mislead us. We must therefore in general early familiarise ourselves with the images which are destined afterwards to furnish the materials of all our judgments; and, with regard to each in particular, the man who devotes himself to it cannot place himself too soon among the objects of his studies, or in that situation which is the most suitable to the nature and design of his observations.

36. Hippocrates was not less favored by circumstances than by nature. The latter had endowed him with the most happy frame of body; the former furnished him from his earliest infancy with every thing which could most successfully contribute to his education.

37. Good sense, joined to the faculty of invention, is the distinguishing characteristic of a small number of privileged men. Hippocrates was of this number. He saw that too much and yet not enough had been done for medicine, and he accordingly separated it from philosophy, to which they had not been able to unite it by their true and reciprocal relations. He brought the science back into its natural channel, that of rational experience. However, as he himself observes, he introduced both these sciences into each other, for he regarded them as inseparable, but he assigned to them relations which were altogether new. In a word, he freed medicine from false theories, and formed for it sure and solid systems; this, he with justice said, was to render medicine philosophical. On the other hand he elucidated moral and natural philosophy by the light of medical science. This we may with propriety call with him the introduction of one into the other. Such then was the general outline of his plan.

38. The fame of the existing schools (says Dr. Parr in his Medical Dictionary) was soon eclipsed by Hippocrates, who seemed to have been the first to whom the appellation of physician in its modern acceptation is due. He first separated it from philosophy, gave it the form of a distinct science, and personally observed the progress of disease as well as the effects of remedies; on this account he is esteemed the inventor of the medicina clinica. Yet perhaps the philosophers who preceded him must not be wholly omitted. We are reminded of Pythagoras, by the Climacterics, by the critical days, and his recommendation of vinegar of squills in deafness; of his scholar Alcmæon, who first described the eye; of Empedocles, who, before any other anatomist, dissected with accuracy the ear; and of Timæus Locrus, who taught that the nervous system was the basis of the whole body on which the nutritious system was gradually extended. Democritus was rather a philosopher and a chemist than a physician, and might have ranked with credit in each class, were the various hints of his labors collected.

39. Of Hippocrates, continues Dr. Parr, it is difficult to speak impartially in a manner that will satisfy his warm admirers, or those who reject every thing that is not of a modern era: and if we look at him as a physician when medicine had scarcely escaped from the trammels of superstition, the refinements of philosophy, or the dictates of antiquated tradition, our admiration will rise almost to enthusiasm; for we shall perceive sound judgment, accuracy of reasoning, and acuteness of observation, superior to his era or the state of science at that period. But to study and admire Hippocrates at this time is very different. Science has opened newer and more extensive views, diseases are distinguished with greater accuracy, and the remedies as they are more numerous may be more appropriately adapted to the circumstances. If we find a striking description in Hippocrates we admire it as a mark of superior genius, and wonder how the same event could have happened both in Greece and England. Yet strip the fact of the disguise of system and it will be found that patient observation would alone have taught it. He fills however so vast a space in the medical scene that some further notice of him and his doctrines will be necessary.

40. Hippocrates was born in the first year of the eightieth Olympiad, 460 years before the birth of Christ, and was descended from a line of physicians, inheriting the instructions of his father and grandfather, themselves descendants from the Asclepiadæ, while his mother traced her origin from the Heraclidæ: he died at Larissa it is said at the age of ninety. He first practised physic at Thasus, afterwards at Abdera, and at last in Thessaly; but his chief residence was at Cos, where the Coan school became for a long

time the successful rival of the Cnidian. All that has been added to these few events is doubtful. That his instructors were Herodicus or Prodicus, and Democritus, rests only on the attention which he has paid to the gymnastic art as well as to anatomy; and the philosophy of Hippocrates is more nearly allied to the tenets of Heraclitus than of the Abderite. As Hippocrates was a great traveller, he might have attended the lessons of Prodicus in Athens, where he chiefly taught; and might there have been acquainted with his brother Gorgias whom he afterwards attended in his medical capacity in Thessaly when worn down with oldage; but we have no records of his having ever practised at Athens.

41. It is not very easy to form a true estimate of the anatomical knowledge and physiological science of Hippocrates. Some of these subjects are treated of in works which are attributed by some to him, and by others are deemed spurious. Le Clerc, however, has taken pains to distinguish these; and the following outline will be very little else than an abridged translation of the work of that learned and laborious author.

42. The doctrine of the four primary qualities of heat, cold, moisture, and dryness, seems to have been held by Hippocrates, and of the primary elements air, water, fire, and earth: he also supposes, and reasons upon the supposition of a leading principle to which he gives the name of nature, about the operations of which he occasionally speaks somewhat vaguely, but in consistency with the spirit and temper of the times, which too much confounded the ideas of final with physical or efficient cause; and which supposed the invention of a term the development of a principle. Indeed if we are to believe the treatises de Flatibus, de Carnibus, de naturâ Hominis, de naturâ Pueri, and de Dietâ to be the productions of Hippocrates we must believe that some of his positions respecting the formation of the hard and the soft parts of the body, from the different elements and qualities and principles in nature, to be of the most whimsical and futile kind.

43. With respect to the anatomical researches and science of Hippocrates it appears, to say the best, very doubtful whether he ever actually witnessed the dissection of the human subject. In the book de Alimento we find it stated that the veins originate in the liver, as the arteries do from the heart. In another part he talks of two orders of vessels proceeding from the heart, namely, the veins and the arteries or rather the roots of these as single vessels. At this time, indeed, the word vein was generally applied to vessels containing blood, and artery to those which were supposed to contain air, Αρτηρια, απο του τον αερα τηρειν. In the description of the heart ascribed to Hippocrates we find it stated that the organ is of a pyramidical figure, of a red color, that it is every where enveloped by a tunic, between which and the heart's substance a small quantity of water is found similar to the urine, that it is a strong muscle, that it has two ventricles, and that it has internal membranes of an admirable structure. And, when he passes from description into the physiology of the heart and connecting vessels, we find some faint intimations of a circulatory movement: all the veins, he says, have a general communication, by which communication nourishment is conveyed through the whole body; and he further supposes or speaks of a rest of vessels—which, say his commentators, necessarily imply the notion of movement or circulation. It is curious that, when adverting to the return or reflux of the humors from the surface to the centre of the body, he makes use of a word which was employed to express the motion of the tides, αμπωτις; from which it has been fairly inferred that Hippocrates although not fully acquainted with the transmission of the blood from, and its return to, the heart, had some faint impression or vague notion that such exit and reflux was effected; indeed the more enthusiastic admirers of the great man concerning whom we are now speaking have not hesitated to say that the modern doctrine of the circulation was known to him; but it is evident, and Le Clerc very properly insists upon this fact when discussing the question, it is evident that this flux and reflux was considered by Hippocrates as effected by the same order of vessels; and the way altogether in which the subject of the motion of the blood and humors is spoken of has a confusedness and vagueness of manner, which is very different from the precision and clearness of the present day doctrine.

44. Neurology, or the doctrine of the nerves, as taught by Hippocrates, was perhaps still more vague and indistinct in reference to its comparison with the physiology of modern times. Nerves, tendons, and ligaments, are evidently confounded together in his writings; and with respect to the brain, and its connexions with other parts of the body, we do not find any thing upon which the modern anatomist can rest with much pleasure, or which modern physiology can recognise as clear and distinct. Hippocrates places the brain among the glands, inasmuch as it appears of the same nature with other glandular substances, being like the glands generally white, and friable, and spongy; and he supposes that the brain charges itself with the superfluous humors of the body as do the other glands, being as they are spongy, and therefore capable of easily absorbing. He moreover imagines its power of absorption from its form and situation, and considers it to be attractive of the body's moisture, which rises into it as vapor, until such time as it becomes surcharged, when this moisture is again transmitted to different parts of the body, more especially to the glands, whence come fluxions and catarrhs.

45. With respect to the other uses of the brain, Hippocrates speaks of it in some of his writings, in his book de Morbo Sacro, for instance, as the seat of understanding and wisdom; although in other places, as in his book de Corde, we find the seat of understanding (γνωμη) lodged in the left ventricle of the heart. It should be observed that our author speaks of two membranous coverings to the brain, the one thick and the other fine in its structure.

46. The organs of sense are described by Hippocrates in the following manner:—The ears have a hole which penetrates as far as a dry and

hard bone, to which is united a fistulous cavity, or an oblique kind of canal, at the entrance of which a very fine and dry cuticle is found, the dryness of which as well as that of the bone produces sound; the air being beaten back as well by the bone as the membrane. On the organ of smell he thus expresses himself:—The brain being moist possesses the faculty of sending out an odor, or of smelling, by drawing the odor of hard materials in with the air which traverses certain dry bodies; the brain itself extending into the nasal cavities. In this organ we find no bone as in the ear, but merely a cartilage similar to a sponge, which cannot well be considered either bone or flesh. When treating of the eye, he speaks of small and very delicate veins which are conveyed into the organ by means of a membrane which envelopes the brain. These veins carry to the eye a very pure humor which comes from the brain. There are, he adds, three membranes enveloping the eye itself; the outer one the thickest, the middle one the most tenuous, and the third which preserves the humidity or the humor of the eye is very loose. If the first be injured the eye is affected, if the second is torn or broken it places the organ in great danger, and it projects like a bladder; but the third is the membrane an injury to which is the most mischievous, on account of its office being that of preserving the humor. The rationale of vision is accounted for very obscurely, and a vein is talked of as being sent from the membrane of the brain and conveying a humor which forms diaphonous, and reflecting membranes. It is very obvious, from the mode in which our author expresses himself in reference to these points, that he had no proper conception of the transmission of the optic nerve; and that he confounds the notions of nerve, and vein, and membranes, and humors, in a way that is any thing but precise and clear anatomy or physiology.

47. The muscular fibre and flesh are likewise described with considerable vagueness; he describes the œsophagus as a tube which extends from the tongue to the stomach; the stomach itself is spoken of as a paunch in which the septic process goes on (Κοιλιη σηπτεχη), or where coction (πεψις) takes place; this coction or digestion being effected, according to him, by the heat of the stomach, which he describes as connected with the liver from which proceeds the necessary heat. It appears that Hippocrates only talks particularly of two intestines, the first attached to the stomach twelve cubits long, always folded and suspended by the mesocolon, which is itself attached to the nerves, which come from the spine of the back, and which pass under the abdomen; the second intestine is covered with a good deal of flesh, is porous, and terminates at the anus.

48. The liver is described as more abounding in blood than the other viscera, and as having two avenues or gates; he talks of its division into five lobes, and as being the origin of the venous system. He speaks of bronchiæ as passing from the heart to the liver, together with the great vein of the organ. He assigns to this organ, the liver, the office of separating the bile, and, as we before remarked, supplying the stomach with heat.

49. The spleen is spoken of as similar in its form to the impression of a man's foot, and as receiving a vein which ramifies into its substance. The organ is, he says, suspended by the omentum which it supplies with blood. He says that it is fibrous, soft, and spongy, and that it draws from the stomach by its spongy consistence part of the fluid from the stomach, to which it is attached; the rest of the fluid being attracted by the urinary bladder.

50. The lungs, according to Hippocrates, have like the liver five lobes; they are spongy, and attract moisture from neighbouring parts. The diaphragm is named by him φρενες, under the notion that it was the seat of intelligence, dividing as it were this locality with the heart; but this office was not universally ascribed to the organ in question, even during the life-time of our author, and it is even contested in a work which has been attributed to Hippocrates himself.

51. The kidneys are placed, by Hippocrates, among the glands; he speaks, as we have above intimated, of their attracting part of the fluids of the stomach. The vesiculæ seminales are mentioned as bodies lying on each side of the urinary bladder, and containing the semen. The organs of generation are rudely delineated in either sex; and the mode in which conception and gestation are effected is traced in a very fanciful and hypothetical manner. We may probably have to allude to our author's notions on these particulars in the article PHYSIOLOGY.

52. When considering the general principles of health and disorder, Hippocrates refers to the four supposed humors, viz. the blood, the phlegm, the yellow bile, and the black bile; the impulse or moving power of these several humors being a spirit, which partakes of the nature of air. The above four humors existing in due proportions, constitute health; disease resulting from a disproportion in either one or more, or an undue impetus in the motion of one or the other, occasions disease without reference to change of quantity. The excitants of disease are air, food, and drink, sleep and watching, exercise and repose, things which are expelled from the body, those which are retained, and the passions of the mind. He also speaks of the reception of exterior substances, as of poisons and venomous animals; but the principal source of disease, according to our author, are aliments and air. Both on the subject of dietetics and of air, Hippocrates therefore treats largely; and, in conformity with the spirit of the times, he supposes heavenly influence to have a share in the immediate production of certain maladies, but it must be admitted that he gave as little as possible into the superstitious notion of celestial workings; and indeed in the book De Morbo Sacro it is expressly stated that we ought not to attach the idea of divine origin to one disorder more than another, for all maladies are in one sense divine, and in another human. Respecting, however, the authenticity of this book, there are, as before stated, some doubts.

53. The modern distinction of diseases into chronic and acute was observed by Hippocrates, and he distinguished them moreover into endemic, or those which are peculiar to a people; epidemic, or those which visit masses of

people in a district at certain times; sporadic, or maladies of different characters affecting a people at the same time; and hereditary, or those disorders which are born with us, and have been transmitted by parents.

54. Crisis and critical days are largely dwelt upon by Hippocrates. He talks of the terminations of diseases as being regulated by the concoction of humors, and of the modes which nature employs to expel these humors from the body after due preparation.

55. The critical periods of our author are formed considerably upon the Pythagorean notion of numbers, and he speaks of every fourth day as having something in it of destinating or regulating power. In disorders which he would call exceedingly acute, the coction of the humors becomes completed and the crisis perfect on the fourth day; the ordinarily acute disease may pass on to the seventh, and sometimes to the eleventh, or even to the fourteenth; occasionally he talks of acute diseases being protracted to the twentieth, or one-and-twentieth day, and at times even to the fortieth and sixtieth: after this last period the disorder is considered as justly entitled to be ranked among chronic affections.

56. After the time of critical tendency is over, in reference to days, Hippocrates supposes the seasons and other circumstances to influence the termination or protraction of disorders; some, for example, terminate about the equinoctial, others about the solsticial periods; others are regulated by the stars and constellations; and there are affections which are influenced by entire months and years; thus certain disorders, incidental to infancy, have reference to the seventh month from birth, and others to the seventh or fourteenth year.

57. Hippocrates does not argue for the absolute necessity of crisis in disorders, but he contends that the termination of acute maladies without them is not so safe and satisfactory as when they have place. He further recognises and speaks of the mutation of diseases, as when inflammation of one part or organ leaves the place originally affected, and falls upon another; or as when cancer of the breast is changed for cancer of the womb.

58. On prognosis and diagnosis the writings of Hippocrates are exceedingly full and particular. He especially speaks of the physiognomy as indicative of danger or otherwise; and his statement respecting the appearances of the countenance, in an individual who is about to sink under the violence of a disorder, has become proverbial. The Hippocratic visage is talked of even in the present day. When, he says, the nose is sharp, the eyes are sunk, the temples hollow, the ears cold and drawn back, the skin hard, extended, and dry, and the color of the face approaching to a leaden appearance, death is certainly approaching; to these signs he adds hanging, relaxed, and cold lips. He takes special notice of the appearance in the eyes. When a sick person is incapable of supporting the light, when he sheds tears involuntarily, when, during sleep, he shows part of the white of the eye, should that not be his habit, or he has no diarrhœa upon him, things are for the most part in a bad state, the last being a particularly unfavorable symptom. A want of the usual brightness of the eye is either a sign of approaching death, or indicates extreme feebleness. A sharp, fixed, and at the same time wild look in the eyes, denotes present or approaching phrenzy. When the individual sees red sparkling or clear bodies floating before his eyes, a nasal hemorrhage may be anticipated, or some critical loss of blood.

59. The manner in which the sick lie in bed is especially marked by Hippocrates as demanding and deserving observation. If the patient lies on one of his sides with a slight curvature, as in health, we may judge favorably of his state; on the contrary, if the individual lie on his back, with the arms and the limbs generally extended, and particularly if he is found gradually to slip down towards the bottom of the bed, a motion which proves that the body is as it were acting by its own weight without any muscular resistance, approaching death may be calculated on. Lying on the abdomen, should this position not be the common one, indicates either delirium or pain in the belly.

60. When an individual who has a fever upon him is continually picking with his hands and fingers, and often putting his hands about his face and eyes, as if to remove something that is irritating him, or pulling about the sheets and coverlet of the bed, as if to take things away that are offensive to him, delirium and death may be predicted; the approach of delirium is also menaced by the circumstance of a person, naturally taciturn, becoming talkative; or, on the contrary, when a great talker becomes all at once silent and reserved.

61. Starting of the tendons (subsultus) is marked as an especially unfavorable omen.

62. Frequent or oppressed respiration is a bad sign, as are continued watchings or want of sleep.

63. The color, the odor, and the consistence of the excrements, are matters of importance to attend to: if the fæces are soft, of a reddish brown, and of due consistence, answering in quantity to the ingesta, and evacuating at accustomed times, and not of an uncommon odor; the symptoms in reference to this particular are favorable; the fæces ought also to increase in consistence as the disorder approaches a crisis. Liquid motions may indeed be considered as importing well, providing they are not discharged with much noise, and not rendered in very small quantities, and very frequently. All watery evacuations from the bowels, whether of a white, or very high color, or of a greenish cast, or frothy, or nauseous, are bad. But the worst sort of fæcal discharges are those which are black and greasy, and those which are of a verdigris color. That discharge which is actually black, and which Hippocrates considers to be black bile, invariably denotes a very high degree of danger. Indeed, bile discharged in any form unmixed with fæcal matter is always a bad symptom.

64. In respect to the urine, that is to be considered the best which readily throws down a sediment of a whitish and equable kind; the notion of Hippocrates in regard to such urine is that this regular sediment denotes a disposition to what he calls, as above intimated, the coction of the humors. When, he says, the urine is

cloudy, and does not show a tendency to become clear by throwing down a sediment, the humors are in a crude unsettled state. When it is unusually white and clear, a very considerable crudity is denoted, and sometimes a transfer of the bile to the brain. Urine which is particularly yellow or red marks a superabundance of bile. Black urine is an exceedingly unfavorable omen, especially if its odor be particularly unpleasant, or if it be either preternaturally thick, or more than commonly clear. Those urinary discharges which appear to have in them a thick meal, or bran, or small bodies like scales or shells, are unfavorable, and denote a disorder in the bladder or the kidneys. Urine, upon the surface of which oily matter is found swimming, marks a disposition to consumptive wasting of the flesh. The sudden discharge of a copious quantity of urine is for the most part critical. The correspondence of the appearances on the tongue with the urinary discharge is pointed out by Hippocrates as capable of recognition, and important to recognize; if for example the tongue is yellow and charged with bile, the urine should be of the same color and condition; on the other hand, if the tongue is red and moist, the urine will be found natural in its appearance.

65. Matters discharged by vomiting ought to be mixed with bile and phlegm; those in which only one of these matters is present are not so favorable. Black, livid, and green discharges from the stomach are bad; and if they have a particularly strong odor, they denote approaching death. Vomiting of blood is often fatal.

66. Expectorated matter, or that discharged from the chest, is favorable in proportion to the facility with which it is thrown out; and, during the early periods of pulmonary disorder, it is not amiss to see that discharge of a yellowish tinge; but if this discoloration continues, or if the matter be acrid, and occasion violent cough, it is a bad sign. If the expectoration be quite yellow, it cannot be considered good; and discharges of a white, glairy, or frothy kind do not relieve the patient. White expectoration denotes a due coction, but then this whiteness must not be accompanied by viscosity, nor should the expectorated matter be either very thick, or very transparent. The same observations apply to discharges from the nose. Expectorated matter that is either black, or green, or red, is bad. But the worst sign in pulmonary affection is when the matter which ought to be thrown off from the chest is retained. Spitting of blood is followed by a discharge of pus, upon which follow consumption and death.

67. Perspiration is favorable when it happens on a critical day, when it is abundant and universal; but cold sweats are always unfavorable. If sweats are confined to the head and neck we may expect that the malady will be protracted and dangerous. Light partial perspirations either point out the seat of the disease, or denote topical weakness.

68. A soft equable condition of the hypochondria and the abdomen always imports well; if upon feeling over the abdomen any irregularities are found, or if one part is more hot than another, or painful to the touch, we may conclude that there is either external or internal inflammation.

69. With respect to the pulse, it is generally admitted that the remarks of Hippocrates do not correspond in precision on this head with those which are made in reference to other particulars. Some indeed have denied that our author recognised the pulse at all in the sense which we give to the term, that is the ordinary and natural beat of the arteries; and, with his confused ideas of the blood's flux and reflux, it is conceivable enough that the circumstance of pulsation would not by him be appreciated as it is in modern times; certain, however, it is, that in the books on Epidemics we read of frequent and strong pulses in acute fevers, and of the trembling, weak, and languishing pulse as indicative of approaching death; but it must still be allowed that on the subject even of fevers Hippocrates dwells much more upon all other symptoms, especially on the variation and degrees of heat, and on the kind of respiration (both highly important points of recognition) than he does upon the character and circumstances of pulsation.

70. We shall now consider the practice of Hippocrates, or the principles upon which he professed to treat diseases, as well as the remedies he was in the custom of employing; on these heads, however, we shall be proportionately less full than on the subjects of signs and prognosis, inasmuch as the maxims and remarks on these last are applicable to all times and all circumstances; while practical or therapeutical medicine varies with varied states of the art, and with the modifications made in disease by time and place.

71. Hippocrates gives the following general principles for regulating medical practice. We must proceed to oppose contrary to contrary; we must evacuate in cases of repletion, and supply materials where there has been too much loss. We must have recourse to heat in cases of cold; and meet superfluous heat by refrigerating measures.

72. We must recollect that there are certain juices or humors which require to be discharged or dried; others which are to be restored. We must be careful not to be very precipitate in our measures, either of depletion or repletion, either of discharge or restoration. We must not fearlessly and abruptly meet heat with cold, or cold with heat, nature being an enemy to every thing that is violent or in excess. We must sometimes contract and sometimes dilate, so as to give facility and freedom to the passage of the humors by the first operation, and restrain their too copious discharge by the second. There are occasions too in which we are called upon to sweeten, to harden, to soften, and to render parts finer or more subtle; sometimes we must give them increased thickness, at other times excite or stir them up, and occasionally it is necessary to blunt the sensibility of the body. It is expedient moreover to take good note of the natural tendency of the humors, and to follow nature as much as may be in her course, not to direct upwards what nature disposes downwards,

or to force in one direction where the natural disposition is to the opposite. We should be solicitous to choose convenient passages for discharges, and not permit matter which has been thrown out from vessels to return. Should we have attempted a course of proceeding without success, we must not be too quick in changing our plans of operation. We ought, however, to be ever watchful as to what obviously agrees or disagrees, or what the patient can and cannot support. Nothing ought to be undertaken rashly; and it is often the part of a prudent physician to stand still and merely watch, without any interference, since nature sometimes cures without the assistance of art, and, when we are doing nothing, we of course are avoiding positive mischief. In extreme disorders, Hippocrates proposes extreme remedies. What medicaments will not effect, may occasionally be effected by iron (cautery), and what this latter fails of performing may sometimes be accomplished by fire. At the same time, we must not think of uselessly interfering when the case is desperate, and beyond the powers of medicine.

73. In the detail of his practical directions, Hippocrates considers largely the subject of purgation, and he has a notion that the several articles which are employed as cathartics have the power of attracting as it were the particular something that requires to be thrown off, and thus effecting its expulsion; that having effected this main operation, of attracting the matter to be expelled, it subsequently takes hold of others; thus, if a medicine which is given for the purpose of purging off the bile is too strong, it takes hold first of the bile, then of the phlegm, then of black bile, and finally of blood. The purgatives employed by him were many of them of the active or drastic kind, such as hellebore, elaterium, scammony, colocynth, buckthorn, &c. The doctrine of concoction of humors, Hippocrates applies to purgative operations; and in some cases this preconception must have led him to erroneous timidity in respect to purgative medicinals, and, indeed we find some inconsistencies on this point; for in one place he talks of the propriety of purging at the commencement of acute diseases, while in others he speaks of its impropriety, till the humors are sufficiently prepared by concoction. Suppositories and clysters were employed by Hippocrates.

74. Bleeding, according to our author, should be instituted under several indications; in the first place, that of evacuation, or taking off a superfluous quantity of blood; in the next place, that of recalling the impetus of the fluid from parts where it is going in too large quantities; thirdly, to procure a more free motion of the blood and spirits generally; and fourthly, to cool the system. In those maladies which appeared to have their seat above the liver, he directed that blood should be taken from the arms, or from some veins in the upper parts of the body; while, in those disorders the locality of which was lower than the liver, he ordered the discharge to be procured from a vessel in the foot, or ankle, or ham.

75. The practice of taking blood by cupping is also spoken of, and directed by Hippocrates, both in the dry way, or without previous scarification, and also after scarifying.

76. When purging and blood-letting did not appear to avail sufficiently in diminishing the quantity of superfluous humors, our author had recourse to diuretics and sudorifics; sometimes simply ordering the bath or wine, to produce an increased flow of urine; at others, employing one or more of the diuretic species of vegetables, as garlic, onion, leek, fennel, &c.; but, when he wished for a more powerful diuretic operation, he administered cantharides, powdered and mixed with wine and honey. He scarcely mentions any particular sudorifics to be taken into the stomach, and in only one or two places alludes to the practice of provoking sweat, by pouring hot water upon the head. Υδατος πολλȣ και θερμȣ κατα της κεφαλης καταχεομενȣ.

77. In harmony with his doctrine of humors, Hippocrates talks of medicaments which increase or diminish dryness, or which resolve or dissipate humors, without actually purging; thereby indicating that class of remedies which would in the present day be called alteratives; and he speaks of drugs which procure sleep; of the mecon (μηκων) he speaks in several places, which was the poppy of the Greeks; but it is curious that he ascribes to this plant generally a purgative quality. There seems in this, as in the instance of hellebore and several other drugs employed by the ancients, reason to believe that the names have not been handed down to posterity correctly. Galen informs us that some considered the peplis and spatling poppy for the same plant; and he mentions, in his commentaries on Hippocrates, that meconium and peplis were often spoken of as the same thing. In addition to medicines acting thus sensibly, or upon certain principles, Hippocrates alludes to the specific virtues of drugs, or those which produce a particular effect without their modus operandi being at all known.

78. External as well as internal medicaments were employed by our author. Fomentations were employed in various ways; the first was that in which the patient sat in a decoction of herbs, so that the part affected should be as it were soaked by them; indeed this was a kind of medicinal bath. A second form of fomentation was that of enclosing hot water in a skin or bladder, or in a copper or earthen vessel, and applying the vessel to the part affected. Sponges too were employed for fomentation; and bran or vetches applied in linen bags. These applications were further made occasionally in the dry way, as by heated salt or millet in bags. Vaporous fomentations were also employed by Hippocrates, of which we find an example in the first book on Female Maladies. He threw bits of red hot iron into urine, and caused the patient to receive the steam from below. His intention in applying these fomentations was to warm, resolve, and dissipate; to draw out peccant humors, to assuage pain, and open or close pores, according as the materials employed were relaxant or astringent. Fumigations also were much employed by Hippocrates; and we find pitch, and sulphur, and other things, employed in this way for the purpose of bringing away phlegm from

the fauces, &c., in quinsies and other affections about the mouth and throat. Gargles too were used by him. And oils were recommended, in the way of friction, to mollify and ease pain, and resolve tumors. We find him farther speaking of ointments and cataplasms, both of the cooling and resolving kind. Powders were also employed externally, such as those used for resolving fungous excrescences, &c.

79. Pharmacy, or the art of compounding or preparing medicines, was evidently cultivated by Hippocrates; and it appears that he prepared medicines himself, or at least ordered their preparation in his own house by his servants; this indeed was common to the physicians of his time, pharmacy then not being, as it is now, a distinct branch of practice, but the physician being at once a practitioner in pharmacy as well as in surgery.

80. Before quitting our account of the medical practice of Hippocrates, we shall add that he gave particular attention to diseases of females, under the notion that the womb, according to one of his axioms, is the cause, or at least the regulator, of almost all disorders to which the female frame is obnoxious. Hippocrates, indeed, imagined that the womb was not only susceptible of relaxation and descent, but he thought it capable of being extended in several divisions up as far as the liver or the heart, and even the head. We find a great number of remedies specified, in his book on female diseases, for these supposed affections of the womb; and he made much use of pessaries, which were occasionally smeared with oily, or stimulating or aromatic substances, according to the indications of treatment. He also recommends injections into the womb in the case of ulcers of that organ, as well as in some other disorders of the part.

81. Hippocrates, as above intimated, was a surgeon as well as physician; indeed the latter included the former in these times, the arts not having, as we have also above stated, yet been divided. We shall, however, defer a history of the surgical precepts and practices of our author till we treat of SURGERY in particular; and shall terminate our account of the 'father and founder of medicine,' by extracting his maxims concerning medicine and physicians in general.

82. Medicine has long since been established, and, as many things have already been discovered, so are we put in the way of discovering several others, if we are fitted for the investigation, and follow the old track of observation. He who rejects every thing that has been already done, and branches out into a new road, boasts of having discovered novelties, but deceives both himself and others.

83. Medicine is the noblest of all arts; but it is one of the least respected on account of the ignorance of those who practise it, and of those who judge rashly concerning it. And what further injures the art is this, that it is the only one in which there is no other punishment beyond shame for those who abuse it, and those who thus dishonor it are insensible of shame. These individuals are a species of actors, representing themselves to be what they are not in reality: they are very numerous.

84. In this, as in other arts, there are good and bad artificers. The art is of great extent; life is short, opportunity easily escapes (οξυς), experience is deceitful, and judgment difficult. Not only must the physician do his duty, but it is requisite that the patient and those about him do theirs; and every thing, to insure success, must be disposed in the best order.

85. To arrive at a high degree of acquirement in medicine the following conditions are necessary:—A natural aptitude, opportunities of instruction, study and application from early life, a docile and well regulated mind, diligence, and time.

86. A physician ought not to be above learning from the meanest persons the results of experience; for it is by multiplied observations collected together that the art is constituted.

87. Some are in the constant practice of finding fault with others, without reaping any other advantages than that of making a vain parade of their knowledge. It appears to me that more wisdom is manifested in finding out useful things, and in perfecting previous observations, than by trying to bring into disrepute, among the vulgar, what ability has produced, and experience confirmed.

88. Those who impugn medicine on the ground that many die under the hands of physicians, in general have as much reason to blame the patient as the physician; but why not impute incurableness to the distemper, rather than want of skill to the physician?

89. Physicians certainly are often in fault; but those that are the least so ought certainly to be the most esteemed.

90. The most skilful and best informed among physicians are sometimes deceived by false analogies.

91. Distempers that are obscure and doubtful are judged of rather conjecturally than by art; but even in these cases the experienced physician has an advantage over one that is not.

92. One physician approves the thing of which another disapproves: it is this which exposes the art to the calumny of the vulgar, who are disposed to consider it altogether vain, and to compare it with the augurs, of whom one says of the same bird, that if it appear on the left it is a good sign, and its appearance on the right is ominous; while another says directly the reverse.

93. In no one instance ought we to speak positively of the success of a medicine, for the minutest circumstance may give rise to variation, and cause a distemper to be protracted and dangerous beyond expectation.

94. The intention of medicine is either to cure disease, or at least to mitigate its virulence; but maladies which are incurable ought not to be undertaken, whether their being incurable depend upon the nature of the sickness, or arise from the destruction of the organ the malady has fallen upon; for it is not in the power of the medicament to reorganise.

95. A physician ought to be frequent in his visits, and exceedingly attentive to every minutia.

96. It is expedient for a physician to have the appearance of health in his countenance; for

the inference is apt to be made, that if he have not health himself he cannot give it to others.

97. A physician ought to be attentive to propriety in his habits, to possess a gravity of demeanor, to be moderate in his actions, and chaste and modest in his conversation with females; he ought not to be envious, unjust, nor a lover of dishonorable gain: he should not be a great talker, but nevertheless ready to give a prompt answer with suavity to every proper question. He should be sober, patient, and ever ready to do his duty; he should be pious without being superstitious, and always conduct himself honorably both in his especial calling and in the general conduct of life.

98. It is not discreditable to a physician, when he feels a doubt about the method of treating a case, to call in the aid of another opinion.

99. As it regards remuneration, a physician ought always to act according to the ability of the patient. On some occasions pecuniary reward ought neither to be asked nor expected; on the other hand the fee may occasionally be given and received in advance, that the patient may with more confidence commit himself to the care of the physician.

100. Those who have considered medicine as having God for its author, have in my mind considered justly. Physicians and philosophers have this in common, that they have the knowledge of the Divinity forcibly impressed on their minds.

101. Such, says Le Clerc, are the principal maxims given by Hippocrates respecting medicine in general, and the duty of its professors. The reader is left to judge for himself on their merits, and physicians may make what use they please of them. It appears from these maxims that there were many physicians in existence at the time when Hippocrates wrote, and but few good ones. It is also evident that consultations were used in his time.

102. Before we quit altogether the part of our history which refers to the 'Coan sage,' it may be right to say a few words on the subject of his writings, and on the question respecting the genuineness or spuriousness of those productions which have been attributed to our author.

103. Under the name of Hippocrates, says Dr. Parr, we have received works of very different value. Those of his predecessors and successors are confounded with his, partly from his having appropriated some of their remarks, in part from the high character he acquired, and from several of his descendants having retained his name. The chief cause, however, of the many spurious works attributed to him, is the avarice of the collectors of Ptolemy, who, when he founded the library of Alexandria, endeavoured to obtain at the most extravagant rates the works of every author of reputation. Every thing under the name of Hippocrates was eagerly received, and it was thought of little importance whether they proceeded from the first, second, or third of that name, so that the reports were not sifted with minute discrimination. To distinguish the real works of Hippocrates has been consequently a problem of no little difficulty. At the expiration of 500 years this task was attempted by Galen, who, with an intimate knowledge of what the successors of Hippocrates had written, possessed a discriminating genius and a critical discernment of the style and manner of the Coan sage, which peculiarly fitted him for the task. Mercurialis, a man of the most extensive erudition; Haller, a physician of vast information, capable of the most incredible labor; and Grumer, possessed of all the indefatigable diligence of his native place, labored in the same field. They have assumed as a principle that Hippocrates was a man of singular abilities, extensive information, consummate candor and modesty. By these tests they have tried every imputed work. Though perhaps the principles might not be readily conceded, yet, as they will certainly point out to our attention the most valuable works, we shall give the result of their labors.

104. The undisputed works of Hippocrates are said to be the first and third books of the Epidemics, two books of the Prænotiones (a different work from the Prænotiones Coacæ, published by Elzevir, in 1660, by Duretus at Paris, and with commentaries by Hollerius at Leyden, which is very certainly spurious), containing the Prognostics and the second book of the Prorrhetica; De Dietâ in Acutis, in opposition to the Cnidian sentences; the Aphorisms; De Aere, Aquis, et Locis; De Naturâ Hominis; De Humoribus purgandis; De Alimento; De Articulis; De Fracturis; De Capitis Vulneribus; De Officinâ Medici; De Locis in Homine. This is nearly the enumeration of Haller; but Galen and Haller seem to have admitted tracts among the Hippocratic works with too great facility. Grumer, who like Haller considered brevity, gravity, and the absence of theoretical reasonings, to be the true test of the genuine writings of Hippocrates, differs in the application. He admits the Oath, but rejects the treatise De Naturâ Hominis, De Locis in Homine, De Humoribus, De Alimento, and De Articulis. Whether the Oath be rejected or admitted is of little importance, since it must be considered rather as an object of curiosity than utility. The first of these rejected works was admitted with hesitation by Galen and Mercurialis, as containing many passages very distant from the manner and doctrines of Hippocrates; but it was retained as containing some facts of importance. The second, though admitted by Galen and Cælius, and though it agrees in general with the practice of Hippocrates, has been suspected on account of some passages of a very different description. Haller only asserts that it may be his work; and Mercurialis, who ascribes it to Hippocrates, thinks that he did not live to complete it.

105. Grumer and Mercurialis reject the tract De Humoribus, but add that it merits attention. It has indeed been commended in every age, and illustrated with commentaries by Galen, Duretus, and Gunzius. The tract on Aliment on the contrary imitates only the terseness of Hippocrates, but betrays the author to be of a later era by the doctrine respecting the arteries and veins. The book on the joints is evidently the work of Hippocrates, or at least of the author of the tract De Fracturis, and universally admitted. It contains also an account of the luxation of the

thigh, which the history of medicine uniformly attributes to Hippocrates, by recording a controversy between him and Ctesias on this subject.

106. Yet even the undisputed works of Hippocrates must be received with some hesitation. The criteria by which they are decided are, we have said, not infallible; for they assume a degree of uniform excellence which perhaps few have possessed. The tract De Aere, Aquis, et Locis, shows the author to have been a European; and various passages, even in the most genuine works, may be adduced to prove that interpolations have crept in. Where then can we draw the line?

107. The style of Hippocrates, says Le Clerc, is very concise, which makes it frequently difficult to comprehend his meaning; to this may be added, that it is grave, and Erotian remarks that there is a similarity between his phrases and those of Homer.

108. His language seems mainly Ionic. Galen observes that the style of Hippocrates inclines somewhat towards the Attic; and he adds that some have considered him as writing in the old Attic.

109. There were several physicians contemporary with him of considerable note in their time, but of such inferior importance in history as scarcely to require notice in the present place. We may mention merely the names of Phæon, Euryphon, Philistion, Ariston, Pythocles, Philetas, Acumenus, and Ægeineus. The sons of Hippocrates were Thessalus and Draco; Polybus was his son-in-law; the first enjoyed the greatest reputation. Ctesian was also a relation of Hippocrates, and contemporary with Xenophon.

110. Diocles was the first in medicine, subsequently to Hippocrates, to make much noise in the world; and on this account he was called by the Athenians the second Hippocrates. A fragment of his is quoted by Galen, which contains a close description of dyspeptic and hypochondriac disorders; his theory of that affection is, that those who are the subjects of it have a superfluous quantity of heat in the veins, which receive the nourishment from the stomach, and that the blood in these veins is consequently thickened, and that thus nourishment is prevented from being distributed through the body, remaining crude upon the stomach and passing the greatest part of it into the lower belly. It is curious to observe in Diocles, an allusion to stomach disorders similar to what is at this very period (1827) the subject of controversy. He states that some conceive that in these affections there is an inflammation at that orifice of the stomach which is connected with the bowels, and that this inflammation occasions a hindrance to the passage of the aliment, and causes the inflation, heat, and other symptoms characterising the disorder. Now, whether in dyspepsia, after it has some time existed, inflammation of the stomach be or be not present is, as we have said, a controverted point among several physicians of the present day. See the several authors who have lately written on dyspepsia, Wilson Philip, Paris, Johnson, and Uwins.

111. Diocles made considerable progress in anatomy considering the impediments of the times in which he lived; but the first great promoters and improvers of this important part of medical and physiological science were Erasistratus and Herophilus.

112. There seems some uncertainty respecting the precise period in which Erasistratus lived. Eusebius places it about the 131st Olympiad, which commenced at the year of the world 3714; but several parts of his history present discrepancies with respect to this alleged time of his birth; for instance, he is stated to have been in great reputation during the time of Seleucus Nicator, who died in the 124th Olympiad. Respecting the part of Greece which gave him birth there seems also to be considerable uncertainty; some have stated it to be Cos, the island in which Hippocrates was born; but it would seem more probable that this supposition has been grounded upon the similarity of the name Cos, and Coa; which last, according to Suidas, was the real birth place of this celebrated man.

113. It seems to be pretty certain that, before the time of Erasistratus and Herophilus, human bodies had not been anatomically examined; and it follows of course that these individuals had opportunities presented them by the permission to investigate human anatomy of a far superior kind to any enjoyed by their predecessors.

114. It is to Erasistratus that we owe the just intimation of a distinct order of vessels in the mesentery as conveyors of chyle; and he with Herophilus were the first to give any thing like a correct account of the brain and nervous system. It has indeed been asserted that Erasistratus recognised two orders of nerves, the one for sensation, the other for motion; and that he described the first as hollow, and taking their origin from the membranes of the brain, while the others originated in the brain itself; but he afterwards spoke of all the nerves originating from the brain itself. He was the first also, according to Galen, to describe, with any thing like accuracy, the membranes which are found about the orifices of the heart, and he speaks of the veins and the arteries as deriving their origin from the heart; but he considers the latter as channels of air, and he supposes respiration to be the process through which air is supplied to the arteries. Some have attributed to him the knowledge of the circulation, but he does not appear to have even been aware of the reason of a double heart. His notion of digestion was that of attrition, as opposed to the concoction and humoral doctrine of Hippocrates; and he differs from Hippocrates in his explanation of the mode in which the kidneys perform the office of separating urine from the blood. He talks moreover of the division of the veins in the liver for the formation of the bile.

115. In his practise Erasistratus was more partial to fasting and abstinence than to blood-letting and purging; and his opinion of disease generally (or rather of febrile disorders) was, that it was occasioned by such a plenitude of the veins as to cause the blood in them to flow into the arteries, and thus to give rise to inflammatory commotion.

116. Respecting the time at which Herophilus lived there seems to be the same uncertainty as

in reference to Erasistratus, some considering him as the contemporary of this last, some making him his predecessor, and some his successor.

117. It was at Alexandria, the capital of Egypt, and under the sanction of the Ptolemies, that both Erasistratus and Herophilus conducted their dissections.

118. Herophilus was the first to point out the optic foramina and nerves, and he speaks still more satisfactorily than Erasistratus respecting the vessels on the mesentery, as being distinct in their œconomy and office from the general venous system. He pointed out also the retina of the eye, and compared that cavity in the brain which goes at present by the name of the fourth ventricle, to the extremity of a writing pen; and described the union of the sinuses, formed by the dura mater; to this day this junction is called the torcular of Herophilus.

119. This author is said to have been the first who described, with any degree of precision, the pulse; and he was so particular in reference to this point, says Pliny, that he contended for the necessity of a knowledge both of geometry and music, in order properly to appreciate the difference of pulsation produced by age and by disorder. Le Clerc, however, contends that this remark of Pliny was founded upon a vulgar error, which attributed this position to Herophilus, because he was the first to make use of the word ρυθμος in application to the pulse. Indeed the precision and science here spoken of seems, as Le Clerc justly remarks, to be inconsistent with the account that has been given, by Galen, of Herophilus, viz. that, in respect to practice, he was half an empiric. Galen actually ranks him among the empirics.

120. Herophilus objected to the prognostics of Hippocrates, and it is surmised that he did so on account of very little attention having been comparatively given by Hippocrates to the pulse. He did not expatiate much upon the curative part of medicine; but it is remarkable that he pointed out particularly palsy of the heart as being a malady which often produced sudden death.

121. It was very shortly after the time of Erasistratus and Herophilus that medicine came to be divided into three parts, the dietetic, the pharmaceutic, and the chirurgical; yet it is observable that, even after the division was acknowledged, the same authors treated of each, the proportion of their attention to one or the other branch being regulated by fancy or by incidental circumstance. The Pharmacopolists of the ancients seem to have been a class of men distinguished from the professors of any of the other branches, and the herbalists were a still different and lower branch.

122. Now also arose the sect of physicians called empirics, who particularly opposed themselves to the anatomical schools introduced by Erasistratus, Herophilus, and their followers. Serapion of Alexandria was the first openly to contend that the science of medicine is and ought to be a mere matter of observation, and that anatomical and physiological knowledge is incapable of affording any real aid in the treatment of disease. Philinus indeed, who was from the island of Cos, is said to be the primary instigator of the empirical creed, and it has even been said that Herophilus was the first to intimate to Philinus the doctrine of experimental observation as opposed to theoretical reasoning.

123. Of Serapion's followers the most famous was Heraclides of Tarentum, who somewhat deviated, it is said, from his predecessors, since he commented on the works of Galen, and dealt in those compositions which seemed to indicate some kind of à priori reasoning as to their separate and combined effects. This inconsistency is charged upon Heraclides by Cælius Aurelianus, who asks how nature or mere accidental observation could instruct men in the composition of medicaments, which seem in the abstract to have so little of correspondence.

124. The question of empiricism and dogmatism is very well discussed by Celsus in his Preliminary Discourse to his Treatise on Medicine, and we recommend its perusal to our young readers, both on account of the fairness and ability with which the investigation is pursued, and the elegant and classical language in which the discussion is clothed.

125. We are now to speak of the introduction of medicine into Rome, or of its transference from Greece to Rome; which, in the infancy of its establishment, was not only indifferent to the reception of the sciences and the fine arts, but was actually jealous of copying the refinements of the Greeks under the apprehension of their eventually leading to effeminacy and weakness. The Romans were said to be nearly 600 years without any medical aid beyond what rude empiricism or blind fanaticism bestowed; and, keeping free from the refinements of their neighbours, they of course did not stand so much in need of the physician's assistance as in after times, when the luxuries of peace took place of the ruggedness of war, and the love of arms ceded to the love of science and art.

126. Rome, says a modern author, formed by the rude tribes of ferocious banditti, wanted for many ages little more than those chirurgical aids which their mode of life rendered indispensable. Epidemic fevers were, however, at times violent and fatal, from the Pontine marshes which were at no great distance from this capital of the world. Yet, for nearly 600 years, they were said to be without medical aid, and their only resources to have apparently been blind empiricism, superstitious charms, or religious ceremonies. Temples seem to have been erected to Febris; and their most destructive enemy, thus raised to the rank of a goddess, was worshipped. In various parts of the city subordinate deities of the same kind were introduced; and no less than three goddesses, Intercidona, Pilumna, and Devirra, were propitiated, by offerings, to confine Sylvanus, who was supposed to be inimical to women in child-bed. In the year 321, ab urbe conditâ, a temple was erected to Apollo for the health and safety of the Roman people; and in 470 Æsculapius, or rather his emblem, a snake, was brought to Rome by a solemn embassy, sent for the purpose to Epidaurus. The snake took refuge in an island in the Tyber, and there the temple of the god was

erected. This fact is of considerable importance in the history of medicine, since it proves that the worship of Æsculapius was continued in Greece at that era; and consequently that traces of record from which as a fountain Hippocrates drew a great part of his observations were still preserved. Some of the votive tablets, hung up in the new temple, are preserved by Gruter, and of a date so late as the age of the Antonines; but these are in Greek, and seem to have owed their origin to the gratitude or superstition of some Greeks who, at that time, resided in the city.

127. It indeed appears singular that while Rome was so little distant from Naples, a Greek city which traced its origin to the Rhodians, among whom Æsculapius was worshipped, should have had no traces of medicine, especially as the Pythagorean philosophy was brought from thence, or from the further provinces styled Magna Græcia, to the Roman kings. The testimony of Pliny, however, is positive; nor is it repelled by Dionysius of Halicarnassus, who remarks in two distinct epidemics, viz. of the years 282 and 400 ab urbe conditâ, that the disease was so violent as to baffle the skill of the physicians; for such would be the language, whatever the medical aid might have been. The stern patriotism of Marcus Cato seems to have prevented the increasing influence of the Grecian physic, and from authority or complaisance Pliny fixed the period of 600 (strictly 535) years during which no physicians were to be found in Rome. It must be obvious that this could not be strictly true; but some resources, either ridiculous or superstitious, must have been sought for when disease occurred. The dietetic system, the virtues of cabbage, adopted from the school of Pythagoras, and the superstitious attachment to the Asclepiadæ, could not have sufficed; but we find little to substitute in their place. The Roman records fail us, and the authority of Cato is supreme. We mean not, in this account, to allude to a law, said to be introduced by Cato, prohibiting the Grecian practice, (for, at the time of the arrival of Archagathus from Greece, he was but fifteen years old); but, to his influence in preventing the increase of the prevailing fashion. The fame of Archagathus quickly faded; for although at first styled Vulnerarius (healer of wounds), he was soon stigmatised by the appellation of Carnifex (executioner). Of the practice of Cato, who wished to supersede the Grecian system, we have hints from Pliny, Plutarch, and his own remaining works. He did not enjoin abstinence, but allowed his patients to eat vegetables. Pliny says cabbage, exclusively, ducks, pigeons, or hares. In fractures and dislocations his remedy was a charm, consisting of hard words without a meaning. The English reader may find some amusement on this subject in the memoirs of Martinus Scriblerus.

128. The bad success of the severer practice of Archagathus soon rendered his successors more gentle in their operations; but some remains of the active Greek surgery continued to prevail, we learn from Plutarch, who informs us that when C. Marius suffered the extirpation of the varices of one leg without a groan, he declined the attempt on the other, saying that the advantages did not compensate for the sufferings.

129. Numerous works have been written to prove that physicians at Rome were slaves, liberti, or foreigners. The opponents of this opinion have been equally voluminous. We must, as usual, give the result of our enquiry without engaging in the controversy. It seems clear that the greater number of practitioners were of the description mentioned, but it is equally certain that many were of a superior character. Archagathus himself was received at first with great ardor, and a house purchased for him; nor on the decline of his credit was he apparently deprived of it. He was also raised to the rank of a Roman citizen, and the Aquilan law declares, that if any physician neglects a slave after any operation he shall be pronounced guilty of a crime. By the same law an action will lie against a physician, who, by the unskilful use of the knife, or of medicine, shall kill a slave, and Ulpian decides that a midwife in the same circumstances shall be pronounced equally guilty. These regulations must relate to free men, and the Aquilan law is confessedly anterior to the age of the Cæsars; for all physicians were by Julius Cæsar raised to the rank of Roman citizens. Varro is also explicit on this subject, when he discusses the question, for what farms it is preferable to have artificers, among whom he reckons medical assistants, occasionally hired, and to what kinds it is better to have slaves attached. In the time of Cato also the Phœnicians had been driven from Sicily by the Romans, and the Macedonians from Greece. The Grecians had therefore recovered a great share of their former liberty. As their language was fashionable, their manners pleasing, their demeanor obliging, perhaps approaching to servility (Juvenal), it is not surprising that they should flock to Rome, nor that they should be favorably received.

130. We are now called upon in the order of time to mention Asclepiades, who was the founder of a new sect of medicine called the Methodic, and who explained all the laws of life and the phenomena of disease upon the principle of the Epicurean philosophy, or rather of the philosophy of Democritus extended and improved by Epicurus. By means of corpuscles and pores, Asclepiades explained every thing. He astonished the people, and was sometimes successful in effecting a cure. He laughed at the ideas of Hippocrates on critical days; he ridiculed his patience in observing nature in order to aid her, or supply her wants; and termed his system a Meditation upon Death.

131. In some consistency with the philosophy of Asclepiades do we find his medical practice. Gestation, friction, and the employment of wine, constituted the three main items of his curative plans, which were all so many means of opening the external and internal pores of the body, and causing the juices and corpuscles to pass from one part to the other freely, and to make their exit liberally.

132. It should seem that the anatomy of Asclepiades was not very correct or extensive, nor was his physiological reasoning entitled to much

commendation. We have spoken of him as the founder of the Methodic sect, but this honor is more strictly due to Themison who succeeded him; and whose system though in some measure harmonizing with the corpuscular philosophy, and regulated by the principles of Asclepiades, was rather, if we may so say, fibrous, than porous; for he divided diseases into those of contracted fibres, those of relaxed fibres, and those of a mixed condition of fibre; in the first he directed evacuants, in the second astringents, and in the third a mixture of both, or rather to meet by the one or the other class of medicaments the most dangerous symptoms.

133. Thessalus, who lived under Nero, about fifty years after Themison, further modified the methodic system especially in its practical bearings; to him has been ascribed the introduction of the metasyncrisial method of treatment, and of causing his patients to abstain from aliment during three whole days, in order to effect a thorough change in constitutional conditions. But it seems that Soranus was most esteemed among the methodical physicians, as having brought the principles of the sect into the greatest degree of practical perfection. This Soranus lived under the emperors Trajan and Adrian. His writings are lost, but their substance is retained by Cælius Aurelianus, who avows that his own works are very little more than a translation of those of Soranus—a translation, for Cælius Aurelianus wrote in Latin. He was indeed an African by birth, according to the most common opinion, but the precise time at which he lived is uncertain.

134. Our limits will not allow us to engage in a lengthened description of the methodic system as it appears in the writings of Cælius Aurelianus: indeed there is in it altogether so much of fanciful and wild, that we should be occupying our time and pages to very little purpose, by transcribing its principles in detail, and we shall content ourselves with the following quotation from Dr. Parr, in reference to the leading doctrine of the methodic school, as, says this author, the cycles of the methodists are often mentioned in medical works, we shall give a short description of the meaning.

135. The cycles were periods supposed to consist of three days each, or combinations of three, and during these the same plans were continued; but at the end of each cycle the exertions were increased, so as at last to arrive at the most active measures. The resumptive cycle consisted of common foods; the metasyncritic of a more acrid and stimulating diet, with frictions, baths, rubefacients, sternutatories, &c. Themison we have said was the principal inventor of this part of the methodic system of medicine. 'The cyclus vomitorius was distinguished into two, as the vomits accompanied the sparer diet of the first, or the more stimulating diet of the second. Each cycle consisted of four diatriti, though sometimes prolonged to sixteen days; the additional diatriton containing four days.'

136. The reader will perceive, in the Asclepiadæan or methodic theory, traces of what we shall afterwards speak of as the humoral doctrine propounded by Boerhaave; and of the system of solidism or fibrous pathology advocated at great length and with much ingenuity by Hoffman, and taught with some modification by the celebrated Cullen.

137. The episynthetic, eclectic, and pneumatic sects of physicians, followed those of the methodic, but their respective peculiarities, as consisting merely in some niceties of bad metaphysics, need not be here dwelt upon; it may suffice to say that the episynthetics affected to reconcile the various discordant opinions of different authors, the eclectics proposed to select from each system the good and practical, and the pneumatics added a governing or spiritual principle to the corporeal or material qualities already recognised; which principle regulated every thing, and occasionally induced disease.

138. Arctæus was the most noted writer among the pneumatic sect of physicians; indeed he is the only author of this sect whose works have descended to modern times complete. It seems uncertain at what precise period Arctæus lived, some have supposed him contemporary with Galen from the circumstance of his never mentioning that author, nor that author him. The principal clue that we have to the discovery of the time in which Arctæus flourished is the dialect of his writing, which is the Ionic, and the circumstance of his being quoted by Paul Eginetus and Aëtius, which proves that he was prior to them. If indeed Arctæus could be proved a contemporary of Galen that would settle the point; for the time in which this last writer lived is as we shall immediately see well known. The writings of Arctæus appear to us to be among the most valuable of ancient records. We may here remark that there is some uncertainty also with respect to the time at which the celebrated Latin writer Celsus lived, some considering him as having been born under the reign of Augustus, others under that of Tiberius, while others again suppose him to have lived so late as the reign of Nero, or even of Trajan. The purity of his style would be almost sufficient to prove him of the Augustan period, and there are other circumstances which favor this presumption. It is curious that Celsus, although one of the best writers on medicine that either ancient or modern times have produced, does not appear to have been himself a medical practitioner. He talks indeed of his observations, but it is supposed that he was merely an observer. Some indeed have gone so far as to imagine that the volumes of Celsus, to which the reader will recollect we have already made allusion, are translations of some Greek author whose name has been lost; for this opinion, however, there does not seem any thing like a foundation; indeed the purity of the style, and the general aspect of the writings of Celsus, would be sufficient guarantees for their originality. We must here repeat our recommendation to the medical student to familiarise himself with the works of this classical author, both on account of the information with which they are pregnant, and the pure Latinity in which they are penned.

139. We come now to speak of the famed Galen, who was born in the second century of the Christian era, under the reign of Severus, and who, for the space of 1500 years, was re-

garded as the oracle of medical science and practice. The birth-place of this celebrated individual was Pergamus a town of Asia Minor; he received the best education of the time under the auspices of a parent, who was himself devoted to philosophy and the belles lettres, and began the study of medicine so early as his seventeenth year, having been it is said directed thereto by a dream of his father.

140. At the time when Galen was born the several sects of physicians, the most conspicuous of which we have just named, were contending for pre-eminence, some practitioners declaring themselves partial to one, some to another, while the eclectics as we have intimated, as indeed their name implies, without attaching themselves to any one code of doctrines, professed to be guided in their philosophy and practice by what of good they found in any of them. To this sect, or rather to these excluders of sects, Galen professed himself attached; but he did not exclude all authority; on the contrary, he avowed his design of restoring the Hippocratic method of considering the objects of medicine, and went so far as to declare himself a disciple and expounder of Hippocrates, who he conceived had been misunderstood or misrepresented, even by those who professed themselves his followers. In commenting however on the works and doctrines of Hippocrates, Galen himself seems to have occasionally given way to the exuberance of a lively imagination, and he seems to have borrowed some of his notions, in respect to animating principles, and regulating essences from the pneumatics.

141. Galen, says Dr. Parr, wrote very diffusely on every part of medicine, but he added only dress and ornament to the system of Hippocrates. In fact minute distinctions, refined speculations, and abstract reasoning, is the whole for which the medical world is indebted to him. They did not lead Galen himself from the path of truth, but they had the most fatal influence on his successors, who speculated when they should have observed, and reasoned when they should have acted. The doctrine of concoction, the most fatal idea which ever occurred, was completely established in the school of Galen.

142. This systematist followed Hippocrates in recognizing three principles in an animal body, viz. the solid parts, the humors, and the spirits; he talked also of four humors, viz. the blood, the phlegm, the bile, and the black bile; the spirits he divided into the natural, the vital, and the animal; the first being nothing else than a subtle vapor rising from the blood, and drawing origin from the liver; these carried to the heart meet with the air we take in by breathing, and become the vital, which themselves are converted into the animal by the action of the brain; these several spirits answer to, and become the instrument of three sorts of faculties—the first or natural having its residence in the liver, and serving for nutrition, growth, and generation; the second, the vital, being situated in the heart, and communicating heat and life to all parts of the body; while the animal faculty is lodged in the brain, which, joined with the rational, distributes feeling and motion through the instrumentality of the nerves, and presides over all the inferior faculties. He supposes three species of actions effected by these three faculties; viz. the natural, the vital, and the animal. He divides the actions of the system moreover into internal and external. The internal actions of the animal faculty being imagination, reasoning, and memory; and the external, the five senses of seeing, hearing, tasting, smelling, feeling, with sentiment, and notion generally. The internal actions of the vital faculty are the violent passions, such as anger, while the external ones are the pulsation of the arteries, and the distribution of blood, and communication of heat and life throughout the frame. The internal actions of the natural faculty are sanguification, digestion and its consequences, and even desire; the external ones are the distribution of the venous blood for nourishment, augmenting, preserving and propagating the species. Besides these general faculties, Galen speaks of other more particular ones which reside in different parts of the body, and which apply to the several demands of these several parts. The stomach, for example, digests by means of its concocting faculty, it attracts nutrition by its attractive faculty, it retains the aliment by its retaining, and discharges it by its expulsive faculty. If we ask what is the primum mobile of all these faculties and functions, Galen, with Hippocrates, replies, it is nature.

143. Health, our author maintains, depends upon the due adjustment of all these faculties, upon the regular distribution of the humors, the proper symmetry of the organic parts, and the harmonious union of the whole; which the reader will be ready to exclaim, is, after all, only to say that health is health; and indeed very little more is predicated by these circuitous modes of expressing absolute circumstance than would be made out by the use of the most common terminology; nor should we have detained the reader with the above sketch, principally borrowed from Le Clerc, of Galenian philosophy, were it not that it is incumbent on us, while professing to give the history of the science, to dwell on the prominent features by which such history is characterised; and did we not feel that the curious, in tracing things to causes, are likely to find an interest in ancient metaphysico-pathology, if we may be allowed the term, from the circumstance that much of ordinary language, in reference to common as well as medical matters, is deducible from the pseudo-philosophy of ancient times. The great error, it will be seen, that pervades the whole of these assumptions, and terms, and inferences, is the localising of presiding powers, the substitution of terms for the exposition of fact, and the confounding of final with efficient cause.

144. When Galen, however, descends from his metaphysics, and discourses on the essence of disease as consisting of plethora and cacochymy his doctrines become more tangible in the way of discussion; and we may shortly state that he imagines these two circumstances, fulness of vessel and depravation of the humors, to be the two great origins of diseased states. In consistency with the Hippocratic doctrine, to which

we have already referred, of the four assumed humors, Galen considers that, beside general plenitude beyond the grade of health, as it regards the blood-vessels, there may exist a bilious, a phlegmatic or pituitous, and a melancholic plethora; but he makes this distinction between the sanguineous and the three other species of plethora: viz. that when either of the latter exists, either separately or conjointly, it mixes with the blood and causes a cachomytous condition of the humors, the morbid condition of the system which thence results being marked by excess of heat, or cold, or dryness, or humidity, or acrimony, or sharpness, or saltness, or sweetness, or any other quality. Even of general plethora he admits of two kinds—the one relative to the vessels, the other to the powers of the system—the former being present when the blood is absolutely superabundant, the other existing when the forces of the body are only equal to the propulsion or management of a certain quantity of blood, and the quantity then becoming, relatively to the powers circulating it, superabundant.

145. On symptoms, diagnosis, and prognosis, Galen treats pretty largely: but we do not find matter under these heads sufficient to detain our readers. Indeed, both as it respects causes and signs and distinctions, there appears to us a good deal of mere verbiage, and certainly no improvement upon his master Hippocrates. On the varieties of pulse he is rather more interesting; but even in this particular we find fancy and conceit occasionally to take the place of observation and truth. We may understand the minuteness, however, with which Galen attended to the circumstance of pulsation, from his having pointed out among others the mouse-tail kind of beat, by which he meant to designate that sort of pulsation which seems as it were to slide through the fingers in the manner of a rat or mouse's tail, and which strikes the different fingers with varied degrees of power.

146. In respect to the practice of Galen we may remark, in the first place, that blood-letting was employed more generally by him than by Hippocrates. He was the first to talk of the precise quantity of blood to be taken in this and that disorder. The principles upon which he directed blood-letting were similar to those of Hippocrates: viz. to lessen fulness, to drive it from parts affected, and to cause revulsion. When the patient was in circumstances to demand bleeding and purging, at the same time, he commenced by the former—which, by the way, may be generally stated not only a good practice, but as an important principle of practice.

147. Anodynes and soporifics were in greater use by Galen than Hippocrates; internal sudorifics were not much employed by him; he occasionally gave specific medicines, or those the modus operandi of which he professed not to understand; but, for the most part, he professed to administer medicaments rather from a principle of philosophical inference than from mere observation, and in this particular, as pointed out by Le Clerc, there was a considerable difference between him and Hippocrates.

148. Galen's anatomical knowledge was of course more extensive and accurate than that of Hippocrates, inasmuch as the actual inspection of human bodies, though still effected with difficulties and obstructions, was certainly occasionally had recourse to, and we have already stated it to be a doubtful point whether Hippocrates had, even in a single instance, enjoyed the opportunity of human dissection. Galen divides the body into four parts—the abdomen, the thorax, the head, and the extremities. The containing parts of the abdomen he describes as the skin covered by the epidermis, or outer skin, the membrane under the skin, and the fat: these are the parts common to this cavity and to other portions of the body, while the parts peculiar or proper to the abdomen are the abdominal muscles, the peritonæum, the epiploon, the stomach, the intestines, the mesentery, the liver, the spleen, the kidneys, the ureters, the urinary bladder, and the generative organs. This division of the intestines is that which obtains even to this day, namely, into duodenum, jejunum, and ilium; cæcum, colon, and rectum. His physiology of assimilation is expressed in the following manner:—The mass of aliment, having arrived in the intestines, is met and received gradually by the meseraic veins, which have the power of attracting the chyle mixed with this mass, in the same manner that the roots of trees draw their nourishment from the earth; they also commence the conversion of this chyle into blood, and carry it to the liver. After the chyle has thus been separated from the alimentary mass the rest of the mass becomes excrement, and is voided by the anus. The liver Galen recognises as the organ principally destined to the formation of blood, and as the origin of all the veins of the body. The spleen is considered as a tissue of vessels like the liver, but being different in the kind of vessels of which it is composed—the latter being principally made up of arteries, while the liver is formed merely of veins: he speaks of the spleen as attracting the black blood from the veins of the liver, thence drawing its nourishment, and transmitting the superfluous portion to the stomach by means of a short vein.

149. We have a description given of the kidneys, and of their blood-vessels coming from the aorta and the vena cava; the ureters are also described as transmitted from the kidneys and terminating in the urinary bladder, which has its sphincter for preventing involuntary discharges. He speaks of the organs of generation in the male and female as being the same, with the exception of difference in size and position; and his theory of generation supposes a mixture and combination of the semen of the female with the semen of the male.

150. In describing the anatomy of the thorax, Galen speaks of the diaphragm, and of a membrane which comes from the parieties of the chest and furnishes the same covering to the lungs and heart that the peritonæum does to the abdominal viscera: he speaks also of a separating membrane between the two cavities of the chest. When describing the heart he speaks of its straight, transverse, and oblique fibres; he describes the pericardium or enveloping membrane of the organ, speaks of the auricles and ventricles of the heart, of its valves, and points out

the difference between the fœtal and adult heart in reference to the distribution of its vessels. He speaks of the lungs as formed of a parenchymatous substance, similar to the liver and the spleen: he mentions the trachea as of cartilaginous formation, points out the laryngeal cartilages, speaks of the situation and office of the epiglottis, describes the thymus gland, but is obscure both in his account of the mode in which respiration is performed and of the vascular connexion of the heart with the lungs.

151. When on the subject of the brain, Galen speaks of the pericranium, of the five sutures, of the dura mater and its sinuses, of a fine or choroid membrane under the dura mater, of the larger and smaller brain, of the ventricles, plexus choroides, pituitary and pineal glands, &c.; and here we have a good deal of wild speculation concerning the use of these several parts of the brain, such as the ventricles receiving and conveying away superfluous moisture, and receiving air from without and preserving the animal spirits in a proper condition. As to the general office of the brain, our author considers it the seat of the understanding, and as giving origin to the nerves. He speaks of the nerves from the cerebellum as principally appropriated to motion, while those from the larger brain are for the sentiments. He speaks of seven pairs of nerves—the optic, the motores oculorum, the lingual, the gustatory, the auditory, the sixth pair immediately following these and giving origin to the recurrents, and the seventh going mainly to the muscles of the tongue. From the spinal marrow he recognises sixty pairs of nerves; the organs of sense are described with some degree of minuteness, more especially the eye; for it is remarkable that in Galen's account of the interior of the ear he is extremely defective: he does not even describe the Eustachian tube, which was discovered and described many years previously to the time in which he lived.

152. Galen speaks of arteries, veins, and nerves as three distinct kinds of vessels; he says the nerves convey sensation and the faculty of motion through all the parts of the body; that the veins and the arteries both convey blood from the centre of the body to its circumference; but that the blood of the veins, which is the grossest, serves to nourish parts, while that of the arteries, being more subtle, is for the purpose of vivifying them.

153. Lastly, we may state in reference to the anatomy of our author, that his description of the bones and muscles is occasionally correct as well as minute; but at times there appears to be reason to suppose that he takes his account from apes and other animals whose external form comes nearest to man, for want of opportunities whence to describe the actual anatomy of the human subject.

154. The epoch of Arabian medicine is so well though briefly given by Cabanis, in his Sketch of the Revolutions of Medical Science, that we shall use the freedom of transcribing the section of that work which refers to this particular.

155. From Galen to the time of the Arabians, says the author just named, medicine appears to have revolved in the circle of the opinions which we have seen successively prevail among the Greeks. Its condition during the continuance of the eastern empire is little worthy of attention. We might perhaps in this interval find some observations worth collecting with respect to the hospitals which were at that time established at Constantinople, and in several other cities of Greece, in Europe and Asia; but this subject has but a remote connexion with that now under consideration.

156. The Alexandrian library, which had been formed by the unremitted care of a long succession of princes friendly to the cause of learning, was burnt during the war between Cæsar and Pompey. A violent insurrection having taken place in the city, Cæsar ordered the ships that were in the harbour to be set on fire. The fire communicated on a sudden to the buildings of the library, and not fewer than 400,000 volumes were consumed by the flames.

157. However this loss was in a short time replaced, at least as far as it could well be. Antony made a present to Cleopatra of the library of Pergamus, which contained 200,000 volumes. This stock was by degrees augmented; the books attracting men of letters, and the men of letters, on the other hand, created an influx of more books. In this manner Alexandria became again the emporium of the sciences and arts.

158. Medicine, in particular, was taught there with much success. Students from all quarters of the globe resorted to it to receive the instructions of the most celebrated masters in the world; and this school, which had been founded in the happiest age of Greece, was still enjoying an undiminished degree of credit when the conquest of Egypt by the Saracens took place.

159. Amron, who commanded the expedition, was desirous to save the library; the answer of Omar is well known. Thus a treasure of incalculable value to the whole human race perished through the barbarous fury of Mussulmans.

160. Yet the proscription was less general with respect to books of medicine, of natural history, and of natural philosophy. Some few escaped destruction either on account of the interest which the most stupid men take in the science which promises them health or an alleviation of their complaints; or, as some writers are of opinion, on account of the idea which generally prevailed in the east, that they would learn from them the art of making gold.

161. The first versions of these books which appeared were in the Syriac language; for the Arabian translations are of a later date. The works of Aristotle and Galen were those for which the Arabians evinced the most enthusiastic admiration. They translated them with the greatest care, and commented on them in different ways and with different views. Their subtle minds were admirably adapted for the Peripatetic system of metaphysics, and for that farrago of abstract propositions which bears down the small number of just and ingenious views it contains. Their literati, who were as fond of pillage as their warriors, appropriated to themselves the ideas that were to be found in works

of little note; and sometimes did not scruple to lay claim to whole books, only taking care to suppress the name of the author. Even their most celebrated writers are not altogether free from this reproach.

162. To the Arabians we are indebted for some important improvements in the art of preparing medicines. They introduced into practice the use of mild cathartics or lenitives: and Rhazes, an Arabian physician, is the first who describes the small-pox. The moderns, no doubt, have far surpassed him in the observation of the different characters it assumes, and of the appearance it exhibits according to the age, the temperament, the state of the body, and the epidemical constitution prevalent at the time when the disease occurs; but it is delineated with much accuracy in his writings; and till the time shall come when the practice of inoculation (simplified as it has been by the beautiful discovery of Jenner) shall have completely effaced it from the catalogue of diseases, Rhazes and some other Arabians who have treated of this disorder (by the way we may remark that Cabanis is not correct in saying that Rhazes was the first to describe the small-pox), will continue to be read with much profit.

163. The works of Hippocrates were translated into Arabic at the same time with those of Aristotle and of Galen. But his simplicity, his precision, his doctrines founded upon experience, that prudent philosophy and rigid method which observes with care the footsteps of nature, were far from exciting the same degree of enthusiasm as the scientific pomp and imposing luxuriancy of the two others; and indeed the Arabian systems of physic have always retained this cast, for in them we look in vain for that genius and that delicacy of discernment which are to the science of medicine what taste is to the polite arts.

164. If we regard merely the absurdity of the enterprise, and the stupid ferocity which gave birth to it, the crusades were nothing more than a cruel and superstitious disorder of barbarous times. But we must at the same time admit that they became very powerful means of weakening and diverting the force of feudal tyranny; and, above all, that they tended to enlarge the intercourse between the ignorant Europeans and the Saracens, who at that time were more enlightened. It also appears that we are indebted to them for the first notion of the municipal system of law. It was at Jerusalem that a class of citizens suddenly emerged from amid the Christian armies, and that their chiefs, by conferring upon them different functions of the magistracy, were enabled by their aid to keep in subjection those bands of turbulent nobles who till then had known no authority.

165. Besides, the better informed part of these nobles, who returned to Europe, brought with them a number of new ideas. The flourishing aspect of the towns and palaces, inhabited and embellished by the Arabian chiefs, and the luxury and conveniency which they exhibited, had naturally inspired them with new desires; and either from this circumstance, or from their connexion with the Genoese and Venetian merchants, the crusaders began first to perceive the value of the arts, and afterwards that of the sciences which elucidate them, or of the literature which enlivens them, which serves them for a guide, and forms, as it were, their necessary accompaniment; and soon diffused a taste for them through the western world.

166. The unfortunate remains of the Alexandrian school, which had escaped the fury or rapacity of the Saracens, were collected by the emperors of the east. While the Arabians endeavoured to promote the advancement of science in Asia and Spain, Greece retained some faint traces of her former splendor. The scenes of so many glorious exploits, of so many feats of genius, and of the industry of its ancient inhabitants, were still before their eyes. The first productions in the most beautiful language that ever was spoken were in the hands of every one; the monuments of which the avarice of the Romans had not been able to deprive them, and those which the luxury of the emperors of Constantinople had raised, at a vast expense, supplied their lively imaginations with ideas that favored the development of all the mental faculties; and, if it had not been for the theological disputes which the folly of princes had kindled, their genius might have shone with a lustre at least as strong as can be expected to emanate among a people that had lost its liberty.

167. It will have been observed that in the above account, taken from Cabanis, the author scarcely alludes to any other physician than Rhazes, who was indeed the great luminary of the Arabians; but, before his time, Isac, Sera pion, and Avenzoar flourished; then afterwards Avicenna wrote very voluminously, and Averrhoes, Alsaravius, and many others, become conspicuous by their works. What the Arabians principally did for medicine was the introduction of several new drugs which the east supplied; but even on this point, as well as in reference to the literature of the art, a great deal was often assumed as novelty which, as above intimated, only consisted in change of nomenclature, or in unacknowledged copies from the Greeks and Romans; nor was the plagiary detected until the time when the Europeans received back, partly by the crusaders and partly by the Saracenic invasion of Spain, that learning which had emigrated and so long been confined to the eastern part of the world. It is a curious fact that the Europeans, at the time to which we are now alluding, actually first became acquainted with the works of Hippocrates and Galen through the medium of Arabic translations.

168. Historians usually at this epoch have introduced to the notice of their readers the particulars of Jewish medicine. The Jews migrating to Spain with the Moors, and still constituting a separate and distinct people, opened schools at Toledo, Grenada, and other parts, and became celebrated as physicians. They became the subjects of persecution; but, in spite of objections raised against them, continued, for a long time, to maintain their ascendancy in public repute, especially in the northern parts of Europe. Scarcely any of their works, however, remain as memorials of the ground of distinction which they so long retained; and they at length became

lost and amalgamated (we now speak of them merely as physicians) with the people among whom they sojourned and associated; and there are no particulars upon which we need at all rest, until the time when chemical medicine came into vogue. What is called alchemy was of Arabian origin. It was in the east that those dreamers first began to speculate and to operate who believed in the transmutation of different metals into gold, and in the existence of a something, could it but be found, which had the power of prolonging the duration of life to an unlimited period. In the researches set on foot to obtain these secrets, and accomplish these objects, many useful facts and principles incidentally unfolded themselves; and as the fanaticism of the crusades was followed by collateral and unlooked for good, so did the folly of the alchemists work out many of nature's secrets, which but for the extraordinary impulse now alluded to might have still remained unknown. But not only did the general fanaticism of the times, but the fanaticism and folly and rudeness of one individual, and that an unlearned man, operate a considerable change upon the character and complexion of medical speculation; and, like Brown in a later period, did Paracelsus at the beginning of the sixteenth century effect a very material revolution in the science and art of healing. This extraordinary man, says Cabanis, whom the solitary practitioner cited by Bordeau calls the greatest fool of physicians and the greatest physician of fools, was unquestionably the prototype of mountebanks—a perfect pattern of pride, madness, and impudence. From the obscurity of the alehouses of Basle he practised upon the credulity of princes, and even of some men who were in other respects very enlightened for their age. Leaving these disgraceful haunts, and attended by a multitude of infatuated adherents, he poured forth a volley of lies, absurdity, and abuse, against his rivals. He proscribed every thing that was not his—he cried, with a frantic voice, 'Away with Greek, Latin, and Arabic!' and he publicly burnt the works the fame of which he was desirous to destroy.

169. Such was Paracelsus, who fancied himself a great man because his name was oftener mentioned in all parts of Europe than that of his contemporaries. Since that time the severest justice has succeeded this infatuation, and there is not a single physician whose opinion is allowed to have any weight who has not perceived the inconsistency of his ideas, and the extravagance of his pretensions. How often have all the odious and ridiculous features in his conduct been exposed and detailed! and yet justice compels us to acknowledge the real services which he rendered to science; the utility of the remedies he first introduced into practice, or which he employed with more boldness and success than his predecessors; and that peculiar sort of sagacity he possessed, which, without meriting the name of real genius, prepares the mind for certain discoveries to which a more cautious mode of procedure never could have led.

170. Paracelsus had perceived the principal errors of the prevailing systems of physic, and had some distant idea of the reforms which they required; and, if his natural disposition had allowed him to do justice to those whom he impudently copied, while he was abusing and reviling them; if he had not been constantly obliged to work upon the passions of the multitude which surrounded him, he no doubt would have been able to promote to a great degree that revolution which was sooner or later to effect the revival of the true science of medicine in Europe.

171. It cannot be questioned that the speculations and dogmata of Paracelsus very considerably influenced the medical doctrines and practice of the times in which he lived; and, although perhaps the most respectable portion of his contemporaries and immediate successors preserved their faith in Hippocratic and Galenic medicine; the chemical mode of reasoning on pathology, and the application of chemistry to medicinal composition, came to be very generally admitted soon after the period at which Paracelsus first announced chimerical novelties, and broached his strange compound of alchemic, astrological, and magical pretensions.

172. Van Helmont is the next of the chemical physicians who demands notice in this place. This celebrated individual had consumed a great part of his youth in studying the works of the alchemists. To him has been ascribed by some the first discovery of factitious airs, and, although there is some error in this unqualified ascription, there cannot be a doubt that much credit is due to him for the mode in which he considered the doctrines of aëriform existence. He was undoubtedly an independent observer, and an original thinker, and we shall here take occasion to make an extract from his writings, which indeed we have already presented to our readers in the article CHEMISTRY; but which, as remarkably illustrative of the workings of an ingenuous and ingenious mind, and as by no means inapplicable to our present purposes, we may here not improperly again introduce.

173. 'In 1594,' says Van Helmont, 'I finished my courses of philosophy, but upon seeing none admitted to examination at Louvain who were not in gown and hood, as though the garment made the man, I was struck with the mockery of taking degrees in arts. I, therefore, thought it more profitable seriously and conscientiously to examine myself, and then I perceived that I really knew nothing, or at least nothing that was worth knowing. I had, in fact, merely learned to talk and to wrangle, and therefore refused the title of M. A., finding that nothing was sacred, nothing true; and I was unwilling to be declared master of the seven arts, when my conscience told me that I knew not one. The Jesuits, who then taught philosophy at Louvain, expounded to me the disquisitions and secrets of magic, but these were empty and unprofitable conceits; and instead of grain, I reaped stubble. In moral philosophy, when I expected to grasp the quintessence of truth, the empty and swollen bubble burst in my hands. I then turned my thoughts to medicine; and, having seriously read Galen and Hippocrates, noted all that seemed certain and incontrovertible; but was dismayed, upon revising my notes,

when I found that the pains I had bestowed, and the years I had spent, were altogether fruitless; but I learned at least the emptiness of books and formal discourses and promises of the schools. I went abroad, and there I found the same sluggishness in study, the same blind obedience to the doctrines of their forefathers, the same deep-rooted ignorance.'

174. It may easily be imagined that an individual, who would think and express his thoughts in this free manner, would not be likely to subscribe to the dicta of established systems; and we find him accordingly breaking through the trammels of the schools, both Hippocratic and even chemical, and proposing dogmata, independent of either. It may be here remarked as a fact worthy observation, that Van Helmont was the first systematically to propound the principle of stomach agency in exciting sympathetic affection to an almost unlimited extent. This sympathetic doctrine has lately been propagated and talked of as something entirely novel; but the merits of the modern pathologists in reference to stomachic influence consist rather in simplification, if we may so say, than in originality; for Van Helmont threw out the idea, but he was not contented to confine himself to the simple fact, but in consistency with the tendency of the times; viz. that of imagining occult and intelligent agencies in the regulation of vital phenomena and morbid incident; he exalted the stomach influence, or rather the influence of the central nerves, into an esssential and governing principle, to which he gave the name of archæus. But we are here tempted again to extract from a modern author in reference to Helmont's views, as the mode in which the doctrine is delineated appears to us so exceedingly just, and to the English reader of the present day so particularly interesting.

175. Van Helmont, says Cabanis, had spent his youth in studying the works of the adepts. Endowed by nature with a glowing imagination, he increased its ardor by his acquaintance with them; and the fire of their furnaces had the effect of completely inflaming his mind. Yet, amid the tarnish of alchemy and superstition by which his ideas are too often obscured, vivid gleams of light are at times observed to appear. It was in pursuing the path of error that he made several fortunate discoveries, and it was in the language of quackery that he announced the sublimest truths.

175*. Van Helmont was one of the most inveterate opponents of the Galenian system, and of the schools which were most in vogue in his time. He indeed allows no opportunity of attacking the latter to escape him; and frequently combats them with great justice and discernment. Nothing could be more unlike his system of physic than that which was then generally taught; but the circumstance of thinking differently from the rest of mankind is not always a sure criterion of thinking rightly.

176. Van Helmont had the merit of being the first who demonstrated the influence which the epigastric organs exert upon the rest of the system. Some obscure hints of this influence were no doubt to be found in the writings of Hippocrates; but the latter appears to have noticed it merely for the purpose of observing the narrow limits within which he supposed it to be confined. No one, after this time, seems to have paid particular attention to the subject, till Van Helmont perceived the potent action of the stomach upon other organs of the body, and that of the digestive power upon their respective functions. He remarked, too, that the diaphragm, which is placed both as a partition and means of communication between the thorax and abdomen, becomes in consequence of its connexion with other parts, and the vicinity of some of the most important viscera, a principal centre of action in the economy of the living system.

177. Numberless facts may be added in support of this opinion. The physicians of the Montpelier school have collected those that are most striking, and have illustrated them in different works with much more method and perspicuity than Van Helmont could have done.

178. Each organ has a sensibility peculiar to itself, although closely connected with, and subordinate to, that of the whole system; particular properties serve to distinguish it from all the other organs; and certain functions are exclusively ascribed to it. Van Helmont supposed that the characteristic distinctions of the different parts of the body depend upon the causes that animate them; and believed that in each organ there resided a principle charged with its government; that a superior principle, to which the author gave the name of archæus, had the superintendence of all the rest; and that from their concurrence and systematic combination the general principle of life results, in the same way as the body itself is formed by the union of all the members. The great archæus is supposed to arise at the superior orifice of the stomach; whence, as it were from his throne, he issues orders to the inferior archæi, according to their different jurisdictions. The latter, though obliged to obey, even the caprices of the former, take care always to add something of their own, either good or bad; and it is in all these operations combined, that the regular actions of the healthy state, and the anomalous appearance of disease consist.

179. The art of medicine then, according to the above theory, consists in the faithful study of the character of the common central principle, and of the nature of the other inferior principles; in knowing when to rouse their industry or suppress their rage; and what are the proper means of governing their passions, or correcting their mistakes. All this, translated into common language, implies, that in animated bodies there exists a general cause of the operations of life; that the different organs, though constantly dependent upon this cause, have, nevertheless, certain modes of being affected and of acting peculiar to themselves, which are the necessary consequence of their peculiar structure; that the object of medicine is to trace the laws by which this cause is governed; to determine the modifications it undergoes in different parts of the system, and in different circumstances, and to ascertain the means of operating, both upon the whole system in general, and upon any organ

in particular, in order to preserve or re-establish the regularity of its functions.

180. This doctrine is confirmed by the observation of nature. It was upon it too that Van Helmont grounded his practical views. Unfortunately he fancied that genius could supply the place of observation; and, rejecting with disdain the facts which had been collected by his predecessors, he boldly adopted plans of treatment that were entirely novel. After the example of Paracelsus, he aimed at the prolongation of human life; he flattered himself that he had discovered the secret, and proclaimed it with the greatest assurance; and, like his predecessor, he shortened his days by those brilliant discoveries which ought to render their authors immortal.

181. We have now arrived at the commencement of the seventeenth century, at which time Dr. William Harvey of London first announced the very important discovery of the blood's circulation; a discovery which furnished a new ground for the whole body of physiological and pathological speculation. Most of Harvey's contemporaries refused to subscribe to the fact, while some endeavoured to deprive the author of the merit of the discovery. We have already had occasion to see how confused and imperfect even Galen's views were with respect to the mode in which the blood makes its passage from the centre to the circumference; he had indeed no idea of a regular circuit. Servetus, the noted object of Calvin's persecution, was a Spanish physician, and in a medico-theological work he mentioned that the blood finds its way from the pulmonary artery into the veins; but, even allowing that such intimation laid claim to a discovery, it is at best but a discovery of the pulmonary circulation, and cannot possibly be considered as any thing like an anticipation of the great Harveyan doctrine. Servetus indeed with Galen limits the blood to the liver and veins generally, and, confusedly and inconsistently with his other assumptions, imagines the heart and arteries to be the instruments of aerial or spiritual transmission. Columbus also, to whom the discovery of the circulation has been attributed by some, although he seemed to have an idea of the pulmonary circulation, and although he described the structure and office of the valves of the heart, fell in with the Galenic notion of venous origin; and Cæsalpinus, who very shortly followed him, still manifests confusion when he mentions the mode in which the system is supplied with alimentary blood; in a word, the actual transmission from, and return to, the heart of the mass of circulating blood, was first unequivocally detailed and explained by Dr. Harvey; and it might have been anticipated that from this time forward medical doctrine and medical practice, commencing as it were from a new starting point, would have regularly, if not rapidly, proceeded on to a state of comparative perfection. But no; this new instrument of truth was destined to become, in the hands of men prone to error, a new excitation of fanciful and futile hypotheses and systems. As the Paracelsian chemists, and the disciples of Helmont, had derided the Galenic faith, so the chemical æra now in its turn gave way before the fury and fanaticism of a mathematical mania, which by axioms, postulata, and corollaries attempted to explain the functions of life and the features of disease. Nothing now was thought of but hydraulic motion, and mathematical calculation of forces; the circulation of the blood, and the laws regulating it, constituted the whole compass of physiological and pathological principia; and medicine was from first to last correcting circulatory impulse, or changing the circumstances and condition of the blood. How futile and far from truth some of the positions and inferences of the mathematical physicians were, may be inferred from the vast difference of premises and deduction which different theorists broached in reference to the same particulars: while, for example, one estimated the force of the heart at a few ounces, another calculated it to be many pounds. And, with regard to the practical inferences which resulted from these mathematical dogmata, an author, from whom we have already largely borrowed, expresses himself in the following terms:—The new light which was thrown upon the animal economy, by this important discovery (the circulation), served only we may affirm to redouble the rage of systems. Nothing else was thought of but to cause the blood to circulate more freely, to destroy its viscosity, to draw off from the body that which was supposed to be corrupted, to purify it, correct it, and renew it, and to preserve the blood vessels in a relaxed and pervious state. Hence those torrents of aqueous and diluent drinks, with which Bontikoe and his adherents inundated their patients. Hence that sanguinary fury which the partisans of Botalli thought themselves entitled to exercise in their treatment of all sorts of diseases; a fury which, though so often damped in some measure by systematic murders, has ceased only for intervals, and still, from time to time, re-appears in the schools.

182. Thus one of the most beautiful discoveries of modern medicine, far from elucidating the practice of the art, as there was every reason to expect, only had the effect of misleading weak imaginations, dazzled by its splendor; and it may still be doubted whether its application to the knowledge and cure of internal diseases has been of any real use. In surgical cases, even where its assistance is generally regarded as indispensable, might not observation almost always supply its place? and must we not limit its importance to the elucidation of a point in anatomy and physiology, very curious no doubt in itself, but which, if it did not indirectly affect many other interesting questions relative to the animal economy, would perhaps have contributed very little to our knowledge of its true laws?

183. However, under this point of view alone, the discovery of the circulation has been productive of advantages by which the practice of medicine has eventually profited; and the glory of its authors can be contested only by the most ridiculous envy, or the most inconsiderate attachment to paradox.

184. The chemical theories of acids and alkalies, which were applied to the fluids of the living body; the pure mathematical theories, by means of which men, who were in general of in-

[illegible] and geometers, [illegible] functions of the dif[illegible], the hydraulic theories [illegible] which served as the foundation [illegible] calculations with re[illegible] of the blood and other [illegible] the mechanical views that [illegible] the laws of motion, [illegible] the phenomena of life, or [illegible] which may be derived [illegible] with them in the illustra[illegible]; all began to attract [illegible], when there appeared a [illegible] who was destined to effect a real [illegible] of medicine.

[illegible] alluded to is the celebrated [illegible] before we engage in a slight [illegible] the merits of this indi[illegible] the peculiarities of his theory, we are [illegible] to introduce to our readers' notice [illegible] physician, who, by one leading prac[illegible], and by the general substitution of [illegible], and untrammelled observation, for [illegible], and hypothetic inference, did [illegible] the science of medicine than had been [illegible] scholastic and theoretic principles for [illegible] will have been seen that even Hippo[crates] himself (who has justly been called the [illegible] of nature, in contrast with others who [illegible] demand that nature should accommo[date] [illegible] to their postulata, and not them to [illegible], it will have been observed, we say, that [illegible] in the writings of Hippocrates the notion [illegible] concoction of humors, previous to their ex[pulsion], is defended as a principle of practical [illegible]. By others this principle was car[ried] still further into practice; and, at the time [when] Sydenham made his appearance in the [world] of medicine, heating alexipharmic ma[terials] were forced down the throats of the sick, [under] the assumption now referred to, without [measure], and without mercy—without mercy, [we say]; for the sufferings, and manifestations of [sufferings], of the sick, were disregarded among the clamorous calls of a prevailing system thus founded in misconception, and acted upon in cruelty.

185. Sydenham at once saw the error of this plan of treatment, and boldly proposed and carried into effect a reformation, which, as we have above intimated, was attended with practical good of the most unequivocal and extensive kind. But we are here again tempted to make a long extract from an author upon whom we have already made large demands, and whom we always find much satisfaction in quoting; in the present instance the testimony of an enlightened foreigner, given with so much propriety of feeling and freedom from all sort of prejudice, upon the merits of our own countrymen, will be received with the approbation due to its value.

186. When Sydenham (says Cabanis), appeared in England, the science of physic still retained its scholastic form. The progress of the other branches of knowledge had hitherto exerted only a prejudicial influence upon it; and the general spirit of observation was almost entirely unknown. Sydenham, after a short course of study, assisted by a little reading, but guided chiefly by the impulse of a happy genius, undertook to bring back the practice of the art to the path of experience. With the prevailing theories of the time he was but imperfectly acquainted; but this circumstance was perhaps more favorable to his labors, as it could never be embarrassing to his self-love, and as he would find less difficulty in following the footsteps of nature. Among the number of his friends was the illustrious Locke, to whom we are indebted, if not for the first principles of a philosophical method of enquiry, at least for the first demonstration of the fundamental truths on which they are founded. The friendship of such a man sufficiently indicates the disposition of mind of the person who cultivates it, and serves, as it were, for its standard comparison. We can therefore scarcely doubt that the counsels of the philosopher must have greatly contributed to the success of the physician, who indeed acknowledges it himself with candor.

187. Sydenham attacked with the irresistible arms of experience several destructive prejudices which at that time prevailed. The chemists, for instance, had introduced into medicine the indiscriminate use of cordials and of ardent or volatile spirits. In acute diseases, in particular, the abuse of these remedies was very great. Sydenham proved that, in such cases, they were almost always injurious, but especially at the commencement of the disorder. The small pox and other acute cutaneous eruptions were treated by sudorifics alone. Sydenham demonstrated that this mode of practice had been more fatal to mankind than a long succession of destructive wars. His Treatise on the Gout has been generally regarded as a master-piece of description; it is indeed the most perfect account of this disease which we possess; not that this malady always presents itself in the manner in which it is described, but because we can conceive nothing more accurate or ingenious than the plan of observation which he there lays down.

188. Hippocrates, in his Epidemics, had sketched the outlines of a system of physic as extensive as it was original. During several ages his ideas had remained in a manner dormant. Baillou, a Parisian professor, in the sixteenth century, appropriated them to himself, and extended them: not indeed as a man of genius; for he was not such, but at least as an attentive observer, and skilful practitioner. He was even led to consider them in several new points of view.

189. Sydenham, without having any knowledge of Baillou, perhaps even without having read Hippocrates, was led into the same path by observation alone. He pursued it with still greater success; and in this his chief glory consists. It is only since his time that we have become thoroughly acquainted with those general variations to which the character of epidemic diseases are liable; with the relations they bear to each other; and their connexion with the different apparent changes of the atmosphere, or their independence of these changes, which is often very apparent; with the influence they exert on sporadic or local disorders; and, lastly, with the manner in which their succession is

regulated, although the order of it, we must confess, has not yet been subjected to any determinate rules, upon which we can entirely rely.

190. The practice of Sydenham effected a real revolution in physic. It was the triumph, not of a transcendant genius, who reforms every thing by bold and general views, but that of an observer, who investigates with sagacity, who conducts his researches with skill, and who is always guided by a sure method. The theories of Sydenham were, it must be acknowledged, contracted, or even erroneous; and beyond the sphere of his experience, in which his natural penetration supplied the place of all other talents, his ideas were in general very limited; but no physician ever exerted so beneficial an influence on that branch of the art to which all the others are subservient—on its practical application; and, in this respect, no one was ever more deserving the title of the restorer of true medical science.

191. Boerhaave, whose name we introduced immediately preceding the above extract from Cabanis, was in one sense the opposite to Sydenham. He, like some others, was a philosopher before he was a physician; and the medical system which he broached and acted upon, so far from being merely the result of simple observation and strong sense, as in the case of Sydenham, was drawn from the principles of chemical and physical science into which he had been early initiated.

192. This celebrated individual, and amiable man, was in one particular like the eclectics of old: he aimed at incorporating with his own particular views, the best portions of the medical philosophy which had preceded him. We have no reason, says a modern writer, to think that he expected to be the founder of a sect; yet he proceeded with the caution of a veteran, and culled from each the flower which was to adorn his own parterre. Though Paracelsus had burnt the writings of Hippocrates and Galen in solemn state, yet they were not forgotten; and the wise observations of the Grecian sages formed the ground-work of his system. The Galenic doctrine of humors he assimilated with wonderful address to his chemical doctrines, and gave them a specific character, founded on their chemical relations. The mechanical philosophy, then attracting universal attention, added to the fabric; the vessels were cones or cylinders; the fluids, consisting of various particles adapted only to given apertures, were at times forcibly impelled and impacted in vessels to which they were not fitted, and consequently produced numerous complaints.

193. The above extract from Dr. Parr may be taken as an outline of the Boerhaavian system of medicine, which turned upon the lentor and acrimony of the fluids, and upon the impelling and correcting power of therapeutic agents; supposing too that the solid portions of the living system were so susceptible of chemical and mechanical changes, that the laws of life and the phenomena of disease were referrible to alterations of form, or variety of constitution, in all his positions and inferences, forgetting or overlooking, as his predecessors had also done, that the reasoning, even when correct, that applies to formative change or impelling powers has qualifications and limits which demand careful recognition when it comes to be applied to organised being.

194. In a manner to remedy this defect of the Boerhaavian doctrine, the doctrine of Stahl, modified by Hoffman, came to be promulgated. In the opinion of Hoffman the actions of the living solid were to be looked upon as the main springs of disordered being; that to the affection of the solidum vivens the deranged conditions of the fluids are subordinate; and that to 'the exertions of the vital power in changing the direction and balance of the circulation,' are we to look for an explanation of all the varieties which disease assumes. Stahl adopted the same principle, but he carried his notion of living agency to the pitch of a presiding intelligence guarding against the invasion of disease. 'He acknowledged, with Van Helmont, a ruling power, guarding the constitution and repairing every defect that might occur; but with this superintendence he considered the human system as a living and an irritable machine, susceptible of various and irregular motions, and consequently of topical congestions.' To these irregular motions, originating as it was supposed, in the living fibre, the term spasm came to be applied; and it is to the solidists, as they have been termed, in opposition to the Boerhaavian tenets, that we are to trace the introduction of the word spasm, as illustrative of disordered condition of the animate fibre, while the phraseology which talks of humor and acrimony is the phraseology borrowed from the doctrines of Boerhaave.

195. Dr. Cullen tells us, in the preface to his first lines of physic, that, when he was appointed professor in the Edinburgh University, he found the humoral pathology in full force; in the development of his own opinion he, however, expressed himself more partial to the views taken by the solidists; and we find in Cullen the term and notion of spasm to form a conspicuous feature in his pathological code; the reaction to overcome this spasm constituting the perturbation of disease, and yet, being regulated by a vis medicatrix, which is the ενορμων of Hippocrates, the archæus of Helmont, and the ruling power or rational principle of Stahl.

196. The theory of Cullen, which is in fact a modification of the Stahlian and Hoffmanic doctrines of medicine, came to be received and taught in the Edinburgh school; and the terminology of the times was spasm and reaction in place of lentor and acrimony; in other language we might say the principles of the solidists superseded in a very considerable measure the assumptions and inferences of the Boerhaavian pathology. The works of Gaubius, of Haller, and of Whytt; the first, a celebrated pupil of Boerhaave, who considerably modified the doctrines of his master; the second an author of notoriety, who published on the irritability of the fibre, and of whom we shall have more to say under the head of PHYSIOLOGY; and the last a writer on nervous sympathies; all contributed towards a modification of the Boerhaavian and Stahlian theories: and things were in this state

when Brown, in some measure like a second Paracelsus, started into notice—we say like a second Paracelsus, because he boldly and at once avowed his unqualified dissent from all that had gone before him, and not only opposed but ridiculed and contemned all the attempts which hitherto had been made to combine into one systematic whole the principles of life and the causes of disease.

197. Deviation from the state of health, in which the morbid state consists, is not, says Brown, either repletion or inanition, or changes in the quantities of the fluids, whether of an alkaline or of an acid nature; or the introduction of foreign matters into the system; or a change of figure in the extreme particles; or a disproportion in the distribution of the blood; or an increase or decrease of the powers of the heart and vessels as regulating the circulation; or a rational principle governing the actions of the body; or an alteration in the extreme particles as being of too large or too small a size; or an alteration of the pores as being too narrow or too capacious; or a constriction of the superficial vessels from cold; or a spasm of these vessels producing a reaction, as it is called, of the heart and interior vessels; or any thing that any person has yet thought of respecting the cause and nature of the morbid state. On the contrary, health and disease are the same state, depending on the same cause, that is excitement, varying only in degree; and the powers producing both are the same, sometimes acting with a proper degree of force, at other times either with too much or too little: the whole and sole province of a physician is not to look for morbid states and remedies which have no existence, but to consider the deviation of excitement from the healthy standard, in order to remove it by proper means.

198. It will be readily seen, says a modern writer, that this subordination of every thing in the living economy to the leading and master-principle of excitement, constitutes the essence of Brunonian pathology and practice. A subordination that may be illustrated by adducing one or two examples. Suppose an individual to be affected with the disorder called diabetes, which disorder is constituted mainly of an altered quantity and condition of the urinary secretion; at least, that is one of its most prominent characteristics. The philosophy of Brown would teach us that the general systematic derangement, by which the malady is constituted, is the only matter of consequence to attend to; and could we but bring the excitement, that is the healthy actions of the system, to a proper balance and bearing, every thing else would fall by consequence into regularity and order; the functions of the kidneys would be restored to their wonted integrity, and health would take place of disease.

199. Again, suppose that a man falls down in an apoplectic fit, he dies, and you examine the condition of the brain; whether it is or is not laden with an undue quantity of blood and serum; whether some of the blood-vessels of the organ have or have not given way; the main circumstance to be regarded, in appreciating the nature of the affection, is the extent to which the excitement has been implicated; and the only effectual way of warding off attacks of apoplexy or even of remedying them when they are remediable, is not to set about emptying the blood-vessels, which is a debilitating process, and calculated to be destructive of its own design; but to aid the sinking and restore the lost excitement. To cure disorder, upon the Boerhaavian hypothesis, is to correct the acrimony of the fluids, or diminish their lentor, or to open the pores of the body for their exit. The Cullenian would say, Take off spasm from extreme vessels and excite, repress, or regulate reaction; while Brown's disciples would say, Adjust and adapt the excitability to the powers which excite, and you need not trouble yourself about any thing further.

200. This Brunonian doctrine of excitability was modified and complicated by Dr. Darwin into four distinct divisions. All diseases, says this last systematist, originate in the exuberance, deficiency, or retrograde action of the faculties of the sensorium as their proximate cause, and consist in the disordered motions of the fibres of the body, as the proximate effect of the exertions of those disordered faculties.

201. The sensorium possesses four distinct powers or faculties, which are occasionally exerted, and produce all the motions of the fibrous part of the body. These are the faculties of producing fibrous motions in consequence of irritation, which is excited by external bodies; in consequence of sensation which is excited by pleasure or pain; in consequence of volition, which is excited by desire or exertion; and in consequence of association, which is excited by other fibrous motions. We are hence supplied with four natural classes of diseases, derived from their proximate causes, which we shall term those of irritation, those of sensation, those of volition, and those of association.

202. Darwin's propositions and principia may be considered the last to have been organised into a body of systematic doctrine. Since his time attempts to generalize have been of rather a different cast: thus, instead of uniting physic with metaphysic and aiming to reduce vital causation, and deranged action to one leading and generally applicable law, in the same manner that gravitation is applied to the phenomena exhibited by inanimate matter; and which attempts, by the way, have all proved nugatory; the endeavours of recent systematists have rather been those of localising disease, or of aiming to prove that affections of this or that part, or primary derangement of one or another organ, are the main springs of general perturbation. Some of these theorists, evincing a disposition to place this fons et origo malorum in the liver, some in the brain, some in the stomach, and some in the fine membrane which secretes mucus and lines internal cavities. And it is a curious fact that the organic theories, if so they may be termed, have seemed to originate in the downfal of the Brunonian assumption of mere general excitement; or rather when it was perceived, as it soon must have been perceived, that these principles were too comprehensive and sweeping to be applied to the complicated organisation of the

living body, the contrary principles, from the tendency there is in the human mind to reacting extremes, came into play; and, as it has been expressed, from no organ it came to be all organ. And there has been another manifestation of opposing principle in the more recent fashion of placing every thing connected with morbid being to the account of the blood-vessels, which is in contradistinction to the nervous theories of the solidists and animists who have just passed by; so it will be seen that the spirit of system, though curbed and crippled by the good sense of modern times, has not yet totally disappeared. Indeed, theory, after all, must more or less influence practice, even among the least disposed to abstract reasoning. 'With some,' says a writer whom we have already quoted, 'the notion of theory, as applied to the art of healing diseases, is considered to be altogether nugatory; and it must be admitted that much of medical doctrine and dicta has prevailed at different times without proving materially influential upon practical indications. I am ready, moreover, to admit, that a large proportion of therapeutic endeavour is conducted, more especially in the present day, under the guidance of an empirical good sense, without reference to the institutes of determined systematists; but still it will be found that the most decided oppositionist to partial views, and particular creeds, is in a greater or less degree influenced in his feelings, and directed in his habits, by the prevailing theories of the times. No one surely will deny that up to the present moment many sensible and unsystematic practitioners are pushing at the liver, and prescribing blue pill, or correcting the chylopoietics, or emptying the blood vessels, or battling at congestion, or thinking about morbid condition of mucous membranes; who, had they been living in the days of Boerhaave, of Hoffman, or of Cullen, would have been acting under the notion of deobstruent agency; have been busily employed in attempts to restore the balance of nervous and fibrous excitation, or in finding out the best methods of resolving spasm, and regulating reaction.' The writer might have added that, had his supposed practitioner been the practitioner of times preceding Sydenham, he might have been waiting for the coction of humors, and permitting the disorder to proceed without interruption till this imaginary process was complete; or he would have been adding irritation to too much already present, under the idea of forcibly expelling humors. Another difference in these cases would not, as it is remarked, be merely in terminology; the medicaments and actual modes of management would also differ; so that it is of some consequence, to say the least, for us to look well to the correctness of propounded principia before we permit them to become either in whole or part 'parcel of the mind.' And it further behoves us to look well towards the correction of another, but opposite tendency, viz. that which refuses to receive any of the good of system, inasmuch as it is mixed with evil. To think is to systematise, and a process of thought must ever precede all acts that are not instinctive or involuntary. 'It is impossible to observe the various appearances in nature without remarking certain circumstances in which they agree; to remark these circumstances is to arrange the similar appearances. It is thus impossible not to systematise; and hence the question should be, not whether systems be useful, but to what extent, and in what mode they can be most usefully formed.'

203. There ought of course to be as little as possible assumed; or rather, the assumption having been once made, its legitimacy ought not to be blindly and obstinately maintained; but, on the contrary, it should be tried by the severest tests of affiliation. Thus, if we find post mortem appearances subsequent to a certain series of symptoms, we may register or arrange the two circumstances under one head of cause and effect; and pleasure may arise from having detected a connexion which has escaped the sagacity of others; but to this supposed discovery such a partiality must not be conceived, as that its cause must be defended against subsequent development of truth. And it is precisely from this point whence all the errors of systematists commence and proceed. When we talk of congested veins, inflamed arteries, disordered tissues, chylopoietic disturbances, and hepatic derangements, as influencing the whole series of organic movements; is not one link only in the chain of causation open to our perception, while the remainder are among the invisible or dimly seen? Are we not apt to overlook the impelling, in our eagerness to grasp at the impelled? In other words, do not we seize hold of one or two striking facts in morbid manifestation, and, hurrying away with them to our closets, mould them into a mass, and eventually throw them out upon the world as presents from nature, whereas they are in reality half the products of our own manufacturing ingenuity? Thus, for a time, the most daring and novel become the most accredited propositions; but as soon as their charm of novelty is gone by, and their propounders are laid in the silent grave, the adventitious separates itself from the real, and the dross is discovered to bear an immeasurably large proportion to the intrinsic of the doctrine.

204. Brown would have effected an abundance of good had he been content to have ridiculed the metaphysical abstractions, or physical absurdities, of preceding systematists; but his failure consisted in attempting another abstraction, in lieu of those he had hurled to the dust; and an abstraction which was still more mischievous in its bearings than those that had gone before; inasmuch as that part of it which was illegitimate and bad was more positively and practically so than its predecessors It is indeed frightful to contemplate the evil that must have resulted from the determined application of his sweeping dogma, which it is surprising was not sooner brought to the ad absurdum test of trial as to its rectitude. But even in this system, degraded as it at present is, a great deal of actual good may be discerned; and a great deal, moreover, of the indirect and direct occasion of those theories that are at present the order of the day.

205. To this circumstance we have already adverted; and we have in some measure anticipated, in the latter clauses of this historical sketch, the second head proposed for disquisition,

we have already referred, of the four assumed humors, Galen considers that, beside general plenitude beyond the grade of health, as it regards the blood-vessels, there may exist a bilious, a phlegmatic or pituitous, and a melancholic plethora; but he makes this distinction between the sanguineous and the three other species of plethora: viz. that when either of the latter exists, either separately or conjointly, it mixes with the blood and causes a cachomytous condition of the humors, the morbid condition of the system which thence results being marked by excess of heat, or cold, or dryness, or humidity, or acrimony, or sharpness, or saltness, or sweetness, or any other quality. Even of general plethora he admits of two kinds—the one relative to the vessels, the other to the powers of the system—the former being present when the blood is absolutely superabundant, the other existing when the forces of the body are only equal to the propulsion or management of a certain quantity of blood, and the quantity then becoming, relatively to the powers circulating it, superabundant.

145. On symptoms, diagnosis, and prognosis, Galen treats pretty largely: but we do not find matter under these heads sufficient to detain our readers. Indeed, both as it respects causes and signs and distinctions, there appears to us a good deal of mere verbiage, and certainly no improvement upon his master Hippocrates. On the varieties of pulse he is rather more interesting; but even in this particular we find fancy and conceit occasionally to take the place of observation and truth. We may understand the minuteness, however, with which Galen attended to the circumstance of pulsation, from his having pointed out among others the mouse-tail kind of beat, by which he meant to designate that sort of pulsation which seems as it were to slide through the fingers in the manner of a rat or mouse's tail, and which strikes the different fingers with varied degrees of power.

146. In respect to the practice of Galen we may remark, in the first place, that blood-letting was employed more generally by him than by Hippocrates. He was the first to talk of the precise quantity of blood to be taken in this and that disorder. The principles upon which he directed blood-letting were similar to those of Hippocrates: viz. to lessen fulness, to drive it from parts affected, and to cause revulsion. When the patient was in circumstances to demand bleeding and purging, at the same time, he commenced by the former—which, by the way, may be generally stated not only a good practice, but as an important principle of practice.

147. Anodynes and soporifics were in greater use by Galen than Hippocrates; internal sudorifics were not much employed by him; he occasionally gave specific medicines, or those the modus operandi of which he professed not to understand; but, for the most part, he professed to administer medicaments rather from a principle of philosophical inference than from mere observation, and in this particular, as pointed out by Le Clerc, there was a considerable difference between him and Hippocrates.

148. Galen's anatomical knowledge was of course more extensive and accurate than that of Hippocrates, inasmuch as the actual inspection of human bodies, though still effected with difficulties and obstructions, was certainly occasionally had recourse to, and we have already stated it to be a doubtful point whether Hippocrates had, even in a single instance, enjoyed the opportunity of human dissection. Galen divides the body into four parts—the abdomen, the thorax, the head, and the extremities. The containing parts of the abdomen he describes as the skin covered by the epidermis, or outer skin, the membrane under the skin, and the fat: these are the parts common to this cavity and to other portions of the body, while the parts peculiar or proper to the abdomen are the abdominal muscles, the peritonæum, the epiploon, the stomach, the intestines, the mesentery, the liver, the spleen, the kidneys, the ureters, the urinary bladder, and the generative organs. This division of the intestines is that which obtains even to this day, namely, into duodenum, jejunum, and ilium; cæcum, colon, and rectum. His physiology of assimilation is expressed in the following manner:—The mass of aliment, having arrived in the intestines, is met and received gradually by the meseraic veins, which have the power of attracting the chyle mixed with this mass, in the same manner that the roots of trees draw their nourishment from the earth; they also commence the conversion of this chyle into blood, and carry it to the liver. After the chyle has thus been separated from the alimentary mass the rest of the mass becomes excrement, and is voided by the anus. The liver Galen recognises as the organ principally destined to the formation of blood, and as the origin of all the veins of the body. The spleen is considered as a tissue of vessels like the liver, but being different in the kind of vessels of which it is composed—the latter being principally made up of arteries, while the liver is formed merely of veins: he speaks of the spleen as attracting the black blood from the veins of the liver, thence drawing its nourishment, and transmitting the superfluous portion to the stomach by means of a short vein.

149. We have a description given of the kidneys, and of their blood-vessels coming from the aorta and the vena cava; the ureters are also described as transmitted from the kidneys and terminating in the urinary bladder, which has its sphincter for preventing involuntary discharges. He speaks of the organs of generation in the male and female as being the same, with the exception of difference in size and position; and his theory of generation supposes a mixture and combination of the semen of the female with the semen of the male.

150. In describing the anatomy of the thorax, Galen speaks of the diaphragm, and of a membrane which comes from the parieties of the chest and furnishes the same covering to the lungs and heart that the peritonæum does to the abdominal viscera: he speaks also of a separating membrane between the two cavities of the chest. When describing the heart he speaks of its straight, transverse, and oblique fibres; he describes the pericardium or enveloping membrane of the organ, speaks of the auricles and ventricles of the heart, of its valves, and points out

the difference between the fœtal and adult heart in reference to the distribution of its vessels. He speaks of the lungs as formed of a parenchymatous substance, similar to the liver and the spleen: he mentions the trachea as of cartilaginous formation, points out the laryngeal cartilages, speaks of the situation and office of the epiglottis, describes the thymus gland, but is obscure both in his account of the mode in which respiration is performed and of the vascular connexion of the heart with the lungs.

151. When on the subject of the brain, Galen speaks of the pericranium, of the five sutures, of the dura mater and its sinuses, of a fine or choroid membrane under the dura mater, of the larger and smaller brain, of the ventricles, plexus choroides, pituitary and pineal glands, &c.; and here we have a good deal of wild speculation concerning the use of these several parts of the brain, such as the ventricles receiving and conveying away superfluous moisture, and receiving air from without and preserving the animal spirits in a proper condition. As to the general office of the brain, our author considers it the seat of the understanding, and as giving origin to the nerves. He speaks of the nerves from the cerebellum as principally appropriated to motion, while those from the larger brain are for the sentiments. He speaks of seven pairs of nerves—the optic, the motores oculorum, the lingual, the gustatory, the auditory, the sixth pair immediately following these and giving origin to the recurrents, and the seventh going mainly to the muscles of the tongue. From the spinal marrow he recognises sixty pairs of nerves; the organs of sense are described with some degree of minuteness, more especially the eye; for it is remarkable that in Galen's account of the interior of the ear he is extremely defective: he does not even describe the Eustachian tube, which was discovered and described many years previously to the time in which he lived.

152. Galen speaks of arteries, veins, and nerves as three distinct kinds of vessels; he says the nerves convey sensation and the faculty of motion through all the parts of the body; that the veins and the arteries both convey blood from the centre of the body to its circumference; but that the blood of the veins, which is the grossest, serves to nourish parts, while that of the arteries, being more subtle, is for the purpose of vivifying them.

153. Lastly, we may state in reference to the anatomy of our author, that his description of the bones and muscles is occasionally correct as well as minute; but at times there appears to be reason to suppose that he takes his account from apes and other animals whose external form comes nearest to man, for want of opportunities whence to describe the actual anatomy of the human subject.

154. The epoch of Arabian medicine is so well though briefly given by Cabanis, in his Sketch of the Revolutions of Medical Science, that we shall use the freedom of transcribing the section of that work which refers to this particular.

155. From Galen to the time of the Arabians, says the author just named, medicine appears to have revolved in the circle of the opinions which we have seen successively prevail among the Greeks. Its condition during the continuance of the eastern empire is little worthy of attention. We might perhaps in this interval find some observations worth collecting with respect to the hospitals which were at that time established at Constantinople, and in several other cities of Greece, in Europe and Asia; but this subject has but a remote connexion with that now under consideration.

156. The Alexandrian library, which had been formed by the unremitted care of a long succession of princes friendly to the cause of learning, was burnt during the war between Cæsar and Pompey. A violent insurrection having taken place in the city, Cæsar ordered the ships that were in the harbour to be set on fire. The fire communicated on a sudden to the buildings of the library, and not fewer than 400,000 volumes were consumed by the flames.

157. However this loss was in a short time replaced, at least as far as it could well be. Antony made a present to Cleopatra of the library of Pergamus, which contained 200,000 volumes. This stock was by degrees augmented; the books attracting men of letters, and the men of letters, on the other hand, created an influx of more books. In this manner Alexandria became again the emporium of the sciences and arts.

158. Medicine, in particular, was taught there with much success. Students from all quarters of the globe resorted to it to receive the instructions of the most celebrated masters in the world; and this school, which had been founded in the happiest age of Greece, was still enjoying an undiminished degree of credit when the conquest of Egypt by the Saracens took place.

159. Amron, who commanded the expedition, was desirous to save the library; the answer of Omar is well known. Thus a treasure of incalculable value to the whole human race perished through the barbarous fury of Mussulmans.

160. Yet the proscription was less general with respect to books of medicine, of natural history, and of natural philosophy. Some few escaped destruction either on account of the interest which the most stupid men take in the science which promises them health or an alleviation of their complaints; or, as some writers are of opinion, on account of the idea which generally prevailed in the east, that they would learn from them the art of making gold.

161. The first versions of these books which appeared were in the Syriac language; for the Arabian translations are of a later date. The works of Aristotle and Galen were those for which the Arabians evinced the most enthusiastic admiration. They translated them with the greatest care, and commented on them in different ways and with different views. Their subtle minds were admirably adapted for the Peripatetic system of metaphysics, and for that farrago of abstract propositions which bears down the small number of just and ingenious views it contains. Their literati, who were as fond of pillage as their warriors, appropriated to themselves the ideas that were to be found in works

allowed such a precedency; and, were it to be granted, there is no none so richly endowed with distinct names for diseases as to enable it to specificate every complaint of which a system of nosology is expected to treat. Dr. Macbride has made a trial of our own tongue, and has completely failed; for the generic terms, under several of his orders, are entirely exotic, and under most of them very considerably so, being partly Greek, partly Latin, and partly English, uncouthly mixed together for the sake of convenience, like foreigners from all countries at a Hamburg hotel.

225. Our choice, therefore, is limited to the Greek and Latin, which have for ages maintained so equal a sway in the province of medicine, that they must still be allowed to exercise a joint control. It is a singular fact, that the Greek has furnished us with by far the greater number of terms that distinguish the higher divisions of systematic nosology, the classes, orders, and genera; and the Latin those employed to indicate the species and varieties. The systems of Linnæus and Darwin offer, perhaps, the only exception to this remark; for here we meet with attempts to use the Latin tongue alone, or at least to give it a considerable preponderancy. These examples, however, have not been followed, and are not likely to be so. The greater flexibility, indeed, and facility of combination belonging to the Greek has, on the contrary, induced almost all other nosologists, as well as almost all other men of science, to turn to it for assistance far more frequently than to the Latin. The author has availed himself of this general taste; and, by an occasional revival of terms which ought never to have been dropped, has been able so far to simplify the nomenclature of his classes, orders, and genera, as to render them exclusively Greek; and consequently to take his leave, thus far, of all other languages whatever. The changes introduced for this purpose are by no means numerous, and will in no instance, as he trusts, betray affectation or coercion. His authorities will usually be found in Celsus or Galen, who have carefully handed down to us the distinctive terms both of the earlier and the later schools of Greece; and, if at any time he has had occasion to wander farther, he has usually supplied himself from Aëtius, Cælius Aurelianus, Dioscorides, or Aristotle. The sources, however, from which he has drawn, are in every case indicated, and, he ventures to hope, will be generally approved. Concerning the specific names he has been less scrupulous; and has allowed those to stand, whether Greek or Latin, that are already in most common use; or has drawn from either language such as may most fitly express the essential character, wherever such character can be traced out. Yet even here he has never wandered from the Greek farther than into the Latin.

226. (2). The machinery of every art or science becomes simpler, and its auxiliary powers fewer and less needed, as it advances towards perfection. It is the same with their technology. While we are but loosely acquainted with the principles of an art we speak of them with circumlocution, and employ more words than are necessary, because we have none that will come immediately to the point. As we grow more expert we learn to make a selection; we give to many of them a greater degree of force and precision; and separate those that are thus rendered of real value from the 'leather and prunello,' the heavy outside show of useless and unmeaning terms with which they are associated; and thus gain in time as well as in power. In unison with these ideas the author, as soon as he has pitched upon a word that will best answer his purpose, will be found, as he hopes, to adhere to it wherever he has had occasion to advert to the same idea, without indulging in any play of synonyms, or different terms possessing the same or nearly the same meaning. Marisca and hæmorrhois have been equally employed by medical writers to distinguish the disease which we call vernacularly piles. The first is a Latin term, and refers to the tubercles of the disease, and the second a Greek, and refers to a discharge of blood which occasionally issues from them. As commonly used they are direct synonyms notwithstanding this difference of radical meaning, and either might answer the purpose; the diversity of the disease being pointed out by distinctive adjuncts, as cæca, mucosa, or cruenta. Sauvages and Sagar, however, have employed both; but have labored to establish a difference, without having succeeded even in their own judgment. So that, in these writers, we have one and the same disease described under two distinct genera in distinct classes; the first occurring in Sauvages under class i. ord. v. entitled, vitia, cystides: the other under class iv. ord. ii. entitled fluxus, alvifluvus, and introduced with this remark, 'hæmorrhoides vero nihil aliud sunt quam mariscæ, gazæ apud Aristotelem.' In the present system marisca is alone retained; and the author has preferred it to hæmorrhois, first, because hemorrhage is only a symptom that characterises a peculiar species, or rather, perhaps, a variety of the disease; and next, because hæmorrhois, or rather hæmorrhoidæ (αιμορροιδαι), was employed among the Greeks, as well vulgarly as professionally, in a much wider sense than that of modern times, and imported flux of blood from the vagina, as well as from the anus; and, in fact, from any part of the body, when produced by congestion and consequent dilatation of the mouths of the bleeding vessels, which were supposed in every instance to be veins. So Celsus, 'Tertium vitium est, ora venarum tanquam capitulis quibuscum surgentia quæ sæpe sanguinem fundunt: αιμορροιδας, Græci vocant. Idque etiam in ore vulvæ fæminarum incidere consuevit.' To the same effect Hippocrates, Lib. de Morb. Mulier. Galen uses it in a still wider extent, De Morbis Vulgaribus: and hence the woman with an issue of blood in St. Matthew, ch. ix. 20, is termed in the Greek text γυνη αιμορρουσα. Gaza (γαζα), the term used by Aristotle, would have answered as well as marisca, but that it is less common in the present day, and an exotic term even in the Greek. Hesychius calls it a Persian word, and Scaliger coincides with him; translating it, 'thesaurus, reditus, tributus,' 'a treasury,' or place of deposit or accumulation, chiefly of tri-

bute or taxes. It is rather an Arabic than a Persian term, though both countries use it under different inflexions. The Arabic root is khazi, 'a blush or ruddy flush,' whether from fulness, shame, or modesty; whence the verb khaza, to produce blushes, erubescence, or suffusion;' and hence khazan in Persian signifies 'autumn, or the season of fulness and erubescence;' while khazain in Arabic is 'a garner, treasury, or repository for the fulness of the autumnal months;' literally cella, cellula, gaza, or gazophylacia, as explained by Hesychius.

227. Vogel and Plenck are overloaded with synonymous terms, or what may, for common purposes, be so regarded; and perpetually aiming, like Sauvages, in the preceding instance, to discover a distinction where none exists, they have multiplied their list of diseases, as we have already seen, almost without number. The discrimination of Cullen has here been employed to the highest advantage, and is entitled to the thanks of every one. Celsus is in this respect peculiarly correct; he adheres to the best technical term supplied by his own tongue; and, though he carefully gives us its Greek synonym, he never changes it for any other term, whether Greek or Latin.

228. (3). In improving the technology of an art or science it seems of great importance not only that all unnecessary terms should be banished, but that those retained should be simplified and abbreviated as much as may be without injuring their force or precision. Nothing can be more repulsive to the eye of a learner, or more inconvenient to the memory of an adept, than the long cacophonous compounds with which the science of nosology has been loaded by several German writers; such as the pothopatridalgia of Zwinger, for which, to the consolation of every one's lips and ears, Nenter auspiciously invented nostalgia; the ancyloblepharon, hydrenterocele, and others already noticed of Vogel, for which it is scarcely worth while to look for better to supply their place, as they import mere shadows of real diseases; and such specific epithets as spondylexarthreticus and hydrocatarrhophicus, employed in the nosology of Plouquet, but far more likely to produce than to remove confusion. To this point the author has endeavoured to keep his eye steadily directed; he has avoided compound terms as much as possible; and, when compelled to have recourse to them, has aimed at restraining them within compass.

229. Much of the character of words in respect to dimensions and euphony, as well as to precision, depends upon the common prefixes and suffixes which it is occasionally found necessary to employ; and which in some branches of science, and especially in that of chemistry, create and regulate considerably more than half their nomenclature.

230. This subject opens a wide field, though the consideration of it, for the present, must be confined to a very narrow compass. It is altogether new, not only to medicine, but, as far as the author is acquainted, to Greek philology; at least, after an extensive enquiry, he has not been able to obtain any assistance from books professedly devoted to it. There seems much reason to believe that the auxiliary parts of every compound term, not only in medical technology, but through the whole range of the Greek tongue, had, when first employed, distinct and definite meanings, and limited the radicals, with which they were associated, to peculiar modifications of a common idea. To these meanings we can still trace many of them, though the greater number, like most of the elements in the Chinese characters, have passed through so many changes, that it is difficult, and in some instances perhaps impossible, to follow up the analysis to their original sources. From the novelty of the subject the author has, perhaps, a fair claim upon the reader's indulgence; the enquiry, however, is worthy of being carried much farther than he has time or limits to pursue it; and he hopes, and has reason to believe, that it will be thus extended, before long, by a friend, who has far more competency for the purpose than he can pretend to.

231. The suffixes employed in medical technology are more numerous than the prefixes, and the following is a list of those in most common use:—

Greek	Agra	αγρα
	algia	αλγια
	asma	ασμα
	asmus	ασμος
	esmus	εσμος
	ismus	ισμος
	osma	οσμα
	cele	κηλη
	copus	κοπος
	esis	εσις
	iasis	ιασις
	itis	ιτις
	odes	ωδης
	odynia	οδυνια
	osis	ωσις
	rhagia	ραγια
	rhoea	ροια
Latin	igo	
	ula	
	illa	
	ularis	
	illaris	
	osus.	

232. The common prefixes are uniformly Greek, and are as follow:—

A	α
apo, ap'	απο, απ'
aph'	αφ'
caco, cac'	κακο, κακ'
cata, cat'	κατα, κατ'
dia	δια
dys	δυς
ec, ex	εκ, εξ
en	εν
epi, ep'	επι, επ'
eph'	εφ'
hyper	υπερ
hypo	υπο
para, par'	παρα, παρ'
peri	περι
syn, sym, sy'	συν, συμ, συ'.

233. These auxiliaries are far too numerous, and, in the course of the vocabulary, recur far

too frequently. Some of them however may be suppressed, as synonyms or duplicates of others; while it should be a rule never to employ any one of the remainder but when absolutely necessary to distinguish the compound into which it enters from the root itself, or from another compound derived from the same root, by the addition of an idea to which it is uniformly restricted.

234. Algia, copus, and odyne, are direct synonyms; to which may also be added agra, for, though of a somewhat different radical meaning, it is commonly superadded, like all the three former, to express the general idea of pain or ache. And hence, very much to the perplexity of the learner and the incumbrance of the technical vocabulary, we have cephal-algia for head-ache, gastr-odyne for belly-ache, chir-agra and pod-agra for gout-ache in the hand or foot. And, worse than this, we have ost-algia, ost-odynia, ost-agra, and osto-copus, to signify one and the same affection of the bones. Now it may be necessary to retain algia, which is perhaps the most popular of the whole, but we should as far as possible banish all the rest; and with the exception of agra in the single instance of pod-agra, which cannot readily be dismissed, none of the others will be met with in the course of the ensuing arrangement. Parodynia will indeed be found, but in this case odynia is the root itself.

235. Esis, osis, itis, oma, and iasis, have been employed perhaps for ages, and several of them very generally throughout the Greek tongue, as mere terminations, without any direct reference to their origins: and probably without a recollection or belief that they have any significant origins, or that those origins can be traced: in which case they would become simple terminating synonyms, and, in the abbreviating aim of a technical nomenclature, ought to follow the fate of the generality of the preceding list. Some of them, indeed, can well be spared; but accident, or a cause not easy to be explained, has given a peculiar and useful meaning to others, though very different from their radical sense, and these may be advantageously retained. The first three are probably derived from εω or its different compounds, and together with the Latin term igo, which is perhaps a corruption of ago, imply the common idea of 'ago, mitto,' 'motion, action, or putting forth,' and consequently, in medical combination, of 'morbid motion or action.' Esis (εσις) is a direct derivative from εω, as is obvious in paresis, literally 'submissio,' 'remissio,' 'laxatio,' 'restraint or inability' of 'moving or putting forth;' whence by Aretæus, and various other Greek writers, it is used synonymously with paralysis. We meet with the same word and the same radical idea in proesis, synesis, and other compounds of the same root. Osis (ωσις or ουσις) descends in like manner from ειμι, 'sum,' itself a derivative of εω; whence osia or ousia (ωσια or ουσια) is literally 'ens, essentia, substantia,' the thing put forth 'in being, action, or motion.' Itis (ιτης) is as clearly an immediate derivation from ιεμαι; itself, like the preceding, a ramification from εω, and imports, not merely action, but, when strictly true to itself, 'impetuous or violent action' The literal rendering of ιεμαι is 'feror impetù,' and that of ιτης is, 'temerarius, audax, præceps periculorum.' While the direct origin of igo betrays itself in all its compounds, for vertigo (deriving igo from ago) is literally 'rotatory motion or dizziness;' serpigo, 'serpentine motion or course,' peculiarly describing a particular modification of herpetic eruption to which the term serpigo is applied.

236. Iasis, and oma, convey different ideas as issuing from different radicals. Iasis (ἰασις) is literally sanatio, from ἰαομαι, 'sano, medeor,' and hence necessarily imports, in composition, 'medendus,' or 'ad sanationem spectans.' Oma (ὠμα) is as obviously an inflection of ὠμος, 'crudus, ferus, imperfectus,' as is its real meaning in sarc-oma, distinctly 'crude, wild, imperfect flesh:' ather-oma, 'crude, incocted pulp or pap.' But if oma be preceded by the letters pt, as in ptoma (πτωμα) it is then derived from πιπτω, 'procido,' and constantly imports procidence or prolapse; as in pro-ptoma, 'a prolapse of any part;' archo-ptoma, 'a prolapse of the anus.' This is sometimes written ptosis, as in colpoptosis, 'a prolapse of the vagina;' hysteroptosis, 'a prolapse of the uterus:' but for the sake of perspicuity, and especially to the learner, one mode only ought to be adhered to, and perhaps the first is the best.

237. Asma (ασμα) is strictly 'incantamentum,' enchantment, incantation; and, in a looser sense, possession, seizure. Osma, asmus, esmus, and ismus, are mere varieties of asma; and that they were at first intended to denote this idea we may judge from the terms phantasma, enthusiasmus, phricasmus, marasmus, phrenismus, priapismus. It became long afterwards a terminal member of tenesmus, rheumatismus, ptyalismus, when the original sense was nearly or altogether lost sight of. And since this period the entire group have been employed not only so generally, but in such a multiplicity of senses, that we can neither banish them nor define them; whence, like esis and osis, they must remain to be had recourse to as mere final adjuncts whenever necessary, though the less frequently employed the better.

238. It is clear, then, as well from actual analysis as from the genius of the Greek tongue itself, that each of these terminations had a distinct signification when first introduced; although it is equally clear that most of them have for some centuries been employed loosely and indiscriminately as mere final syllables. In many instances none of them are wanted; and in all such cases they ought, unquestionably, to be dropped as redundant; and, occasionally, they have been so. Thus the myopiasis of Vogel is advantageously shortened by Plenck to myopia, as at first written by Linnæus; and, for the same reason, mydriasis ought to have been written mydria. So chlorosis, if it were to be formed in the present day, would be chloria, and exoneirosis, exoneiria. Many of the terms introduced by Dr. Young seem to be formed directly upon this basis, and are highly entitled to attention; as phlysis, palmus, pneusis.

239. In various instances, again, we find, as

already hinted at, several of the terminations, apparently from some accidental cause, taking a peculiar bearing which it would be right to encourage, as long as they are retained, so as to give them a direct and definite sense. Such especially is the case with itis, which, from the time of Boerhaave, has been progressively employed to express organic inflammation, as in cephalitis, carditis, gastritis, and most similar affections. In this sense, therefore, when employed at all, it ought to be employed exclusively. And here the etymological idea is directly consonant with the practical: for, as observed already, it imports increased and impetuous action. A few terms only stand in our way, upon this point, even at present, as rachitis, hydrorachitis, ascites, and tympanites; all which, however, are of little consequence, as they have good synonyms, or may be easily varied, as the reader will perceive in the ensuing arrangement.

240. Oma has, in like manner, from some cause or other, a general idea attached to its use, not easy to be explained from its primary signification: it is that of external protuberance, and to this, therefore, it should be confined. We meet with this idea in ecchymoma, staphyloma, atheroma, steatoma, sarcoma, and carcinoma. It does not easily apply to glaucoma; but as this was as frequently called by the Greeks glaucosis, and by the Romans glaucedo, we need not be troubled even with this slight exception. The therioma of Celsus, though continued by Vogel, is banished from general use; and, if it were not, this would also admit of a ready change to theriosis.

241. Iasis is almost as generally appropriated in the present day to denote diseases of the skin, unconnected with fever; the cause of which it seems, also, as difficult to discover as in either of the preceding instances: but, this being the fact, the hint should be taken and the necessary limit applied. We have sufficient exemplification of this remark in elephantiasis, leontiasis, psoriasis, pityriasis, phthiriasis, helminthiasis (applied by Plenck to cutaneous worms and larves of all kinds, except those of the pediculus, but to which malis is preferable) and tyriasis, importing in the same author a peculiar variety of lepra. To these we may add ichthyiasis, as in this case it ought to be written, instead of ichthyosis. Many of these terms are unnecessary, and may be well spared, but they serve as examples of the general turn the final iasis has been lately taking, and to which, whenever it is made use of, it would be right to attend. Satyriasis, sardiasis, and one or two other terms, form exceptions to the general tendency; but they are not wanted, as will be readily perceived in the ensuing pages; while all but the first have been long obsolete, and are almost forgotten. Hypochondriasis is not, strictly speaking, a Greek term. It is comparatively of modern origin, and may be conveniently exchanged for hypochondrias.

242. Cele (κηλη) retains generally, to the present hour, its original sense, which is that of 'a yielding tumor,' especially a yielding tumor produced by the protrusion of a soft part; as in bronchocele, sarcocele, glossocele, bubonocele. Rhagia (ραγια) is, properly speaking, an elision of hæmorr-rhagia, from 'ρησσω, 'rumpo,' to burst or break; and hence uniformly denotes a preternatural flux of blood by the bursting o. one or more blood-vessels, as in menorrhagia, rhinorrhagia, and enterrhagia. While rhœa ('ροια), from 'ρεω 'fluo,' to flow, imports, with almost equal uniformity, a preternatural flux of any other fluid, as in diarrhœa, gonorrhœa, leucorrhœa, ottorrhœa. In perirrhœa, as employed by Hippocrates in the sense of enuresis, we have an exception, as we have also in the modern compound menorrhœa, which denotes a natural flux, and in a healthy proportion. But the first has long grown obsolete and yielded to enuresis; and for the second we may employ catamenia, or menia without the preposition, which is totally superfluous, and omitted in all the compounds of μην, as also in the Latin homonyms menses and menstruatio. All these therefore may remain untouched, and are sufficiently correct in their present use.

243. Odes (ωδης) uniformly imparts 'par, similis,' like or akin, to the subject with which it is connected, as in typhodes, icterodes, phlegmonodes: and is probably derived from ωδε, 'hoc modo.'

244. Illa, ula, illaris, ularis, well known as Latin diminutive terminations, are perhaps derived, as will be more particularly shown hereafter, from the Greek υλη (yle or ule), 'materies,' and import, therefore, 'of the matter, make, or nature of,' as in pupilla or pupula, pustula, fibula. These are opposed by the suffix osus, uniformly a Latin augment, derived perhaps, like osis above, from ωσια or ουσια, 'substance, essence, power:' hence undula is 'a little wave;' undosus 'full of waves;' cellularis 'having little cells;' cellulosus 'full of little cells.' This distinction has not been sufficiently attended to by medical writers, and we have in consequence seen the two suffixes occasionally confounded.

245. The prefixes or initial particles or propositions have far less generally departed from their original sense, though many of them exhibit great looseness, and very different significations. In grouping them we shall find that a, caco, dys, and para, though separated from each other by shades of difference, are all privative or debasing; and that ec, ex, epi, hyper, though separated in like manner, are all augmentative or elevating. It would be better perhaps that *a* should be limited to the idea of total privation, as in agenesia, or aphoria: but the laxity of its use, not only through the whole nomenclature of medicine, but the whole of the Greek tongue, is an effectual bar to such an attempt, as we may readily perceive in atonia, apnœa, adipsia, asthenia, in which it is merely debasing or defective: and it is in this sense that it often becomes synonymous with dys, para, and caco, as in dyspnœa, paralysis, and cacodia (defective power of smelling). Dys, indeed, in its strictest sense, should convey the double idea of defect with difficulty or distress, as in dysenteria, and dysmenorrhœa; and caco the double idea of defect with corruption or depravity, as in cachexia, cacophonia: but this distinction has been little

attended to. Para occasionally embraces a wider range than any of the rest, and runs precisely parallel with the Latin malè, or the Teutonic mes, or mis, so frequent in compound words of our own and the French tongue. In anatomy, however, para is often employed in the sense of apud or juxta, 'bordering on, or hard by'—and in words derived from anatomy it retains this sense in the vocabulary of diseases, as in parotis, paronychia, with no small confusion to the learner: and consequently gives a sense that should be otherwise provided for.

246. It would be better still to avoid the use of all these prefixes as much as possible, with the exception of *a*, which cannot be spared; for, where they convey the direct sense of *a* they are not wanted, and, where they convey no other than that of general morbid action, they are commonly, though not always, superfluous expletives; since the science, in whose service they are thus employed, necessarily implies such an idea, as well without them as with them.

247. The opposite initials ec, or ex, epi, or eph', and hyper, denote alike the general idea of out of, outwards, over, above, in their primary sense, or when applied to place, as in ectropium, epidemicus, hyperostosis; but that of augmentation or excess in their secondary sense, or when applied to quantity or quality, as in ecstasis, epiphora, hyperuresis.

248. En is an initial of very extensive range as well as signification; and it has this peculiar property, that, in different senses, it becomes an antagonist to both the preceding groups in the one or other of their general meanings. In its primary sense, or as applied to place, it imports within, below; as in encephalon, emphysema; and consequently opposes the primary sense of ec, epi, hyper: while in its secondary sense, or as applied to quantity or quality, it exactly accords with these prepositions, and imports superiority or excess, and in like manner opposes the general idea conveyed by *a*, caco, and dys; of which we have examples in enthusiasma and enuresis. En appears therefore to be as necessary an initial particle in the medical vocabulary as *a*; and with these two we should seldom feel at a loss for any other; for as *a* is capable of supplying the place of all the rest in the first set, so en is capable of performing the same office for those of the second. Hypo (υπο), in its signification of below or downwards, is sometimes called upon to act the part of an ally, as in hypogastrium, and hypocondrium, and their derivatives hypogastrocele, and hypocondrias or hypocondriasis; but this is seldom the case, and at all times obtrudes an assistance of which en is not in want: whence hypo might easily share in the preceding proscription. In this general view of the subject, en seems at first sight to be untrue to itself: but it is not difficult to explain the apparent contradiction. En runs precisely parallel with the Latin altè. The leading idea of both is 'power or precedency;' and this, whether the order of advance be from below upwards, or from above downwards. In measuring rank and station, we take the former scale, and speak of high posts and dignities; in measuring intellectual qualities we take the latter, and speak of profound judgment and wisdom. The Greek en and the Latin altè are equally applicable to both; and hence it is that in our own tongue, and indeed in most of the dialects of Europe, high and deep occasionally becoming synonyms, and the same general meaning may be expressed by either. In one respect, indeed, the Greek and Latin terms differ; the former importing depth in its primary, and height in its secondary sense; and the latter importing height in its primary, and depth in its secondary sense. In all these cases, however, the difference of the two meanings is easily understood by the context, and it would be hardly worth while to attempt to limit the Greek en to either sense if we were able. *En* is a short and tractable intitial, and must remain equally to form a contrast with *a*, and with *ex* or *epi*; in the former case to import ascendancy or superiority, as being applied to quantity or quality; and in the latter case to import descendancy or inferiority, as being applied to place; with which distinction before us its meaning can never be mistaken.

249. A word or two will suffice for the remaining prefixes. Cata (κατα) and apo (απο) are two of the most frequent. They have been very little introduced into nosological terms of late; but in those of early writers are far more frequent, and exhibit a great variety of senses; most of which, however, in respect to either prefix, are capable of being resolved into the general idea of iteration or duplicate action, or ideas that obviously ramify from this fountain, and which are usually expressed by the Latin and English particle *re*; as in catapsyxis, re-frigeration; cataspasma, re-traction; catamenia, re-menstruation (importing its regular return); apostema, re-cession, abscession or abscess; apothesis, re-placement or reduction of a dislocated bone. Whence again *apo* is generally used in the sense of back or from, as in apogeusia, apositia, backward, tardy, defective taste or appetite; while both are far more frequently used emphatically or in a superlative sense, as importing reduplicate action or double force; of which we have examples in catacauma, a burn; catagma, a fracture; catalysis for paralysis, catarrhus, apoplexia, apocyesis (parturition). In this signification both are evidently redundant; nor are they much marked in any other.

250. Peri (περι) continues uniformly true to the sense of circum, and is limited to terms derived from anatomy, as peripneumonia and peritonitis. Dia (δια) is nearly as single in its meaning; or rather the different significations in which it is used are capable of being arranged under one leading idea, that of separation, which is the only idea it should be allowed to convey, if ever employed in the coinage of new terms. We trace this general sense in diabetes and diarrhœa, 'a passing off, or flowing through;' diacrisis and diagnosis, 'a judgment or distinction, by the separation of one symptom from another;' diastole and diastasis, a dilatation or separation of part from part.' Syn (συν), and its derivatives sym and sy, are uniformly expressive of conjunction or association.

251. Such are the significations assigned to these auxiliaries whenever employed in the en-

suing system; the author has nevertheless endeavoured to employ them as seldom as possible, and always in a definite sense. The classific names are given entirely without them, and the ordinal nearly so. In this respect he has differed from Dr. Young, who has prefixed the preposition para, importing diseased action, to the name of every class but the last, in which it is exchanged for ec. But this seems a pleonasm; for, in a system directly nosological, para is necessarily implied in every instance. Neuroses or neurismi is just as expressive as paraneurismi; and hæmorrhagiæ or hæmasiæ, as parhæmasiæ. Linnæus has been very particular upon this point, and has never introduced compound terms but when he has thought them strictly called for. In consequence of which we have mentales, quietales, motorii, without any affix whatever.

252. But though the author has felt no occasion for these auxiliaries in denominating his classes, and but little occasion for them in the names of his orders, in his generic terms he has often found it necessary to have recourse to such assistance; in some instances because, though evidently redundant, the affix could not be detached without the appearance of affectation; but more frequently for the purpose of distinguishing the names of different diseases, compounded of the same radical term; as in phyma, écphyma, and émphyma; phlysis, écphlysis, and émphlysis; ecpyésis and empyésis with various others; which, thus compounded, present, at the same time, their relative points of accordancy and of discrepancy, and are consequently more easily, instead of less easily, distinguishable.

253. (4.) As the component parts of a term ought to be restricted to a precise and individual meaning, so ought the entire term, whether compound or single. The common signification of asphyxia is 'apparent death,' whether from suffocation, electricity, or any other cause. Plouquet, in his Initia, has applied this term to a 'temporary suspension of the pulse, while all the other functions of the system, whether corporeal or mental, continue with little or no interruption.' The term, in its original sense (ασφυξια), pulselessness, will bear Plouquet's meaning; but it is at the expense of its general interpretation: and hence, as the disease alluded to by Plouquet has not yet fairly found a place in nosology, and no other term has been devised for it, it will be found distinguished from asphyxia in the present system by the term acrotismus, of meaning precisely parallel.

254. There is a strange confusion in the general use of the terms hemeralopia and nyctalopia. Most modern writers mean by the first, 'vision, irksome or painful, in the light of noon, but clear and pleasant in the dusk of the evening;' and, by the second, 'vision dull and confused in the dusk, but clear and powerful at noon-day.' But this is directly to reverse the signification of both terms, as employed by Hippocrates and the Greek schools; and, as the Greek sense is still occasionally continued, there is sometimes no small difficulty, and especially to a learner, in understanding what diseases are referred to. In the ensuing system most disorders of the sight, unconnected with inflammatory action, are arranged under a common genus, entitled paropsia, of which hemeralopia and nyctalopia become species; and as they are here distinguished by the names of p. lucifuga, and p. noctifuga, it is hoped that the usual perplexity will be found sufficiently avoided.

255. Æsthesia, among almost all the nosologists, imports sensation generally: and hence dysæsthesiæ is employed by Sauvages, Vogel, Sagar, and Cullen, as the name of an order comprising diseases of sight, smell, taste, touch, and hearing; running parallel with the order æsthetica, in the class neurotica of the present system. But Cullen, after having used the term as an ordinal name in this general signification, next employs it as the name of a distinct genus, in the very limited signification of touch alone, and in contrast with all the other senses; anæsthesia, the genus referred to, being defined 'tactus imminutus vel abolitus.' Linnæus, indeed, had already used it with an equal restriction, which he ought not to have done, as the term had been already adopted by Sauvages in its wider and correcter sense. But Linnæus has not fallen into the self-confusion of Cullen, for he has not employed æsthesia or any of its compounds in any other import. To avoid this irregularity, the anæsthesia of Linnæus and Cullen is, in the present system, exchanged for parapsis.

256. Exanthema, among the Greeks, imported 'cutaneous eruptions generally.' Sauvages, and all the nosologists down to Cullen inclusively, together with most other medical writers, have limited it to express 'cutaneous eruptions accompanied with fever.' Attempts have more lately been made to fetter it within a still narrower circle; sometimes by confining it to eruptive fevers produced by specific contagion, whatever be the character of the efflorescence: and sometimes by restraining it to the character of the efflorescence alone, with little attention to its being connected or unconnected with fever. It is in this last view that the term has been employed by Dr. Willan, who limits it to the import of the English term rash, and in his list of definitions explains the one term by the other. In this confined use of the word, however, he does not always maintain his accustomed precision; for after having, in his table of definitions, characterised rash or exanthem as distinct from papula and wheal, he employs exanthemata as the name of an order, embracing diseases by both these symptoms. In Dr. Willan's very restricted use of the term there is great inconvenience, and but little or no authority in his favor; and hence in the ensuing system it is restored to its common nosological acceptation.

257. The limits of the present sketch will not allow the author to pursue this subject much further; but it is necessary to observe, before he entirely drops it, that there are various terms in common use in nosological descriptions, whose meaning in like manner remains in a very unsettled state to the present hour; and which it will be the object of the ensuing attempt to simplify and define. As examples, it may be sufficient to glance at the words pyrexy, apyrexy paroxysm, accession, exacerbation, crisis.

258. Fevers were called by the Greek physicians pyreti, pyrectici morbi, or simply pyrectica. Pyrexia (febricitatio, rather than febris), was in a looser sense applied to fever generally, but limited, when more strictly employed, to febrile heat and increased pulsation. The duration or the cold and hot stages was called its paroxysm, and the interval between one paroxysm and another was distinguished by the term apyrexy (απυρεξια). What the Greeks called paroxysm, the Latins named accession (accessus, or accessio); for the apyrexy of the former, the latter employed the term intermission (intermissio), and if the interval were only a remission, instead of a perfect intermission, the return of the hot fit was denominated exacerbation (exacerbatio); which in fact is a direct translation of paroxysm; so that an exacerbation was the same correlative to a remitting as an accession was to an intermitting fever. The duration of a single exacerbation and its remission, or of a single accession and its intermission, was denominated a febrile period.

259. Sauvages employs the whole of these terms with a pretty strict adherence to their original meaning; but by Cullen and still later writers they have been used with much greater laxity, and occasionally in very different senses. Like many of the Greek physicians, Dr. Cullen has proposed a difference between pyrexy and pyretus or febris; the former of which terms he is well known to have taken as the name for his first class of diseases. While, however, he proposes a difference between these terms, it is not that of the Greek schools, but altogether of his own invention; for instead of limiting pyrexy, as was done by the Greeks when they allowed a distinction, to the mere symptoms of increased heat and increased pulsation, corresponding in a considerable degree with what is now usually called the second stage of a febrile paroxysm, he has connected shivering, or the chief symptom of the first stage, with it, together with the symptoms of 'various injured functions, and diminished strength in the limbs.' By this addition, however, he has considerably overshot his own mark; for he has not only given a new sense to the term, but has frustrated the distinction he intended to establish; insomuch that, when he proceeds to define fever by its ordinal character he has nothing of any real importance to add; for fever in his ordinal definition of the term is still pyrexy, though pyrexy with the comparatively trivial appendage of 'previous languor, lassitude, and other signs of debility, without primary local disease;' and hence, moreover, the term pyrexiæ, upon his own interpretation, applies but very indifferently, as a classific name, to any of Dr. Cullen's remaining orders, except exanthemata; for it is rarely that inflammations or hæmorrhages, his other orders, are preceded by shivering, or accompanied with lesion of various other functions than that belonging to the organ affected, although they usually are accompanied with 'increased heat and pulse,' or pyrexy, in the Greek restricted sense of the term. It is not to be wondered at, therefore, that this distinction of Dr. Cullen, between pyrexy and fever, should have appeared to later writers as perplexed or nugatory; and it was probably under some such feeling that Dr. Parr, and still more recently Dr. Young, in laying down their respective systems, determined upon abandoning all distinction whatever, and upon employing pyrexiæ and fevers as synonymous, or rather univocal terms. It is necessary, therefore, to point out the discrepancy that is at present prevailing in medical technology upon this subject. In the restricted sense in which the term was employed by the Greeks it seems useful and necessary; for we have no other by which we can so well or so shortly indicate those peculiar febrile symptoms which connect the family of phlogoses or phlegmasiæ with that of simple fevers; and it is in this sense, therefore, as importing the joint idea of febrile heat and augmented pulse, detached from the ideas of shivering, languor, and various injured functions, that the term pyrexy will be employed whenever had recourse to in the ensuing pages.

260. The term accession has of late years undergone a still greater change in its meaning than pyrexy. It has been just observed that accessio or accessus was employed by the Latin writers in a sense precisely parallel with the Greek word paroxysm; and that either embraced the cold and hot stages of a febrile seizure, the only stages into which such seizure was divided. And hence paroxysm is a term not to be found in Celsus, who uniformly employs accessio in its stead.

261. Among recent writers, however, and perhaps generally in the present day, while the term paroxysm is applied not merely to fever-fits, but to fits of every violent and intermitting disorder whatever, the term accession is limited to the commencement or onset of a fit, its insultus, as denominated by the Latin writers; and hence Dr. Cullen speaks of the 'accession of paroxysms,' a phraseology which would be nonsense upon the original meaning of the terms; while Dr. Turton, with evident indecision upon the subject, defines accessio, in his Glossary, 'the beginning or paroxysm of an intermitting fever' (allowing the reader to take which sense he will); and paroxysmus 'an access, fit, or exacerbation of a disease;' giving a still greater latitude, as well in respect to the genus, as the stage of the morbid affection. The Latin translators of Galen adhere to the original signification; and hence what Cullen calls the 'accession of paroxysms,' is in their language 'incrementa accessionum:' and the same import is given to the term access or accession by Sauvages, who, in describing the simple quotidian fever, says, 'duratio accessûs octodecim horas non excedit;' and observes of the quotidiana subintrans 'accessus ad viginti quatuor horas fermè extenduntur.' Even in Cullen the term seems sometimes to be employed as a synonym for paroxysm, as in his definition of hectic fever, in which accession is opposed to remission or apyrexy; while in his definitions of the tertian and quartan, in which the words paroxysm and accession are both introduced, the latter is designed evidently to import the commencement or first stage of the former, or 'the accession of the paroxysm,' as in the passage just referred to; that which by

Hoffman was elegantly and correctly denominated the spasmus periphericus, or general spasm of the small vessels diffused over the entire surface; in popular language, the shivering fit.

262. It is not difficult to account for this confusion of sense: for notwithstanding the general appropriation of the word accession among the Latin writers to the whole duration of a fever-fit, or what is now called a paroxysm, its radical idea imports simply 'advance, approach, entrance, avenue;' and in this meaning Celsus himself is perpetually using the term in its verbal form, and occasionally, indeed, in connexion with accessio in its technical signification, as 'donec altera accessio accedat,' 'till another accession accedes or comes on.'

263. Fordyce, probably from its complicate meaning, has banished the term accession altogether, and introduced the phrase cold fit in its stead, retaining, however, paroxysm in its modern and popular sense: so that, according to him, an ephemera is a fever consisting of one paroxysm, which paroxysm comprises three stages, 'a cold fit, hot fit, and crisis.' And here we have a new sense assigned to the term crisis. Among the Greeks it is very well known to have imported a decision or determination of the disease; and hence critical days were, amongst them, days which produced such decision or determination. With Dr. Fordyce, however, crisis imports nothing more than the decision or determination of a single paroxysm of a disease, its decline or sweating stage. Whilst, by many of the humoral pathologists, the term was used in a different sense from both these, and signified, synonymously with the despumatio of Sydenham, the separation and discharge of the crude and morbid material which was the supposed cause of fevers, without any reference to particular days, or particular stages of a paroxysm.

264. It is high time, then, that an exact sense should be fixed for the whole of this group of terms; and with a view of accomplishing this object, as far as he is able, the author will be found in the ensuing pages uniformly to employ, 1. Paroxysm, as importing the entire duration of a fit of acute disease of any kind, whether the interval be perfectly or imperfectly free: 2. Exacerbation, as signifying the paroxysm of a disease, whose intervals are merely imperfect or remissive; which is the strict meaning of paroxysm when literally rendered: and, 3. Accession, as indicating the commencement or onset of an exacerbation or paroxysm of any kind; which restores the term to its radical idea; whilst he has omitted the use of the term crisis, as neither wanted nor conveying in the present day any determinate sense.

Cullen's Arrangement.

Class I. PYREXIÆ. A frequent pulse coming on after a horror; considerable heat; many of the functions injured; the strength of the limbs especially diminished.

Order I. Febres. Pyrexia without any primary local affection, following languor, lassitude, and other symptoms of debility.

Sect. I. *Intermittentes.* Fevers arising from the miasma of marshes; with an apyrexia, or at least a very evident remission; but the disease returns regularly, and for the most part with a horror or trembling.

Genus I. Tertiana. Similar paroxysms after an interval of about forty-eight hours, coming on most commonly at mid-day. A tertian has either;

I. An apyrexia interposed.

1. Varying the duration of the paroxysms.

A, The tertian whose paroxysms are not extended beyond twelve hours.

B, The tertian with paroxysms extended beyond twelve hours.

2. Varying in the return of paroxysms.

C, The tertian returning every day with unequal paroxysms alternately similar to one another.

D, The tertian returning every third day with two paroxysms on the same day.

E, The tertian returning every day, with two paroxysms on every third day, and only one on the intermediate ones.

F, The tertian returning every day, with an evident remission interposed between the odd and even days, but a less remarkable one between the even and the odd days.

3. Varying in its symptoms.

G, The tertian accompanied with a disposition to sleep.

H, Accompanied with spasms and convulsive motions.

I, Accompanied with an efflorescence on the skin.

K, With phlegmasia.

4. Varying in being complicated with other diseases.

5. Varying as to its origin.

II. With the interposition only of a remission between the paroxysms.

Genus II. Quartana. Similar paroxysms, with an interval of about seventy-two hours, coming on in the afternoon.

I. With the interposition of an apyrexia.

1. Varying in the type.

A, The quartan with single paroxysms, returning every fourth day, none on the other days

B, With two paroxysms every fourth day, and none on the other days.

C, With three paroxysms every fourth day, and none on the intermediate days.

D, Of the four days having only the third free from fever, with similar paroxysms every fourth day.

E, The quartan coming on every day, with similar paroxysms every fourth day.

2. Varying in its symptoms.

3. Varying in being complicated with other diseases

II. With a remission only between the paroxysms.

Genus III. Quotidiana. Similar paroxysms with an interval of about twenty-four hours, coming on commonly in the morning.

I. With the interposition of an apyrexia.

1. Varies in being solitary.

A, Universal.

B, Partial.

2. Complicated with other diseases.

II. With a remission only between the paroxysms.

Sect. II. *Continuæ.* Fevers without evident intermission, and not occasioned by marsh miasmata; but attended with exacerbations and remissions, though not always very remarkable.

Genus IV. Synocha. Great heat; a frequent, strong, and hard pulse; high-colored urine; the functions of the sensorium a little disturbed.

Genus V. Typhus. A contagious disease: the heat not much above the natural; the pulse small, weak, and for the most part frequent; the urine little changed; the functions of the sensorium very much disturbed, and the strength greatly diminished.

The species are,

I. Typhus petechialis. Typhus for the most part with petechiæ.

Varying in degree. 1. Mild typhus. 2. Malignant typhus.

II. Typhus icterodes. Typhus with a yellowness of the skin.

Genus VI. Synochus. A contagious disease. A fever compounded of synocha and typhus; in the beginning a synocha, but towards the end a typhus.

Order II. Phlegmasiæ. A synocha fever, with inflammation or topical pain, the internal function of the parts being at the same time injured; the blood drawn and concreted exhibiting a white coriaceous surface.

Genus VII. Phlogosis. Pyrexia; redness, heat, and painful tension, of some external part.

The species are,

I. Phlogosis (phlegmone) of a vivid red color; a swelling well defined, for the most part elevated to a point, and frequently degenerating into an abscess, with a beating or throbbing pain.

The variations are, 1. In the form. 2 In the situation.

II. Phlogosis (erythema) of a reddish color, vanishing by pressure; of an unequal and creeping circumference, with scarcely any swelling; ending in the scaling off of the cuticle, in pustules, or blisters.

The variations are, 1. In the degree of violence. 2. In the remote cause. 3. In being complicated with other diseases.

The consequences of a phlogosis are, an imposthume, gangrene, sphacelus.

Genus VIII. Ophthalmia. A redness and pain of the eye, with an inability to bear the light; for the most part with an effusion of tears.

The species and varieties of the ophthalmia are,

I. Idiopathic.

1. Ophthalmia (membranarum), in the tunica adnate, and the membranes lying under it, or the coats of the eye.

A, Varying in the degree of the external inflammation.

B, In the internal coats affected.

2. Ophthalmia (tarsi), of the eye-lids, with swelling, erosion, and glutinous exudation.

II. Symptomatic.

1. From a disease of the eye itself.

2. From diseases of other parts, or of the whole body.

Genus IX. Phrenitis. Violent pyrexia; pain of the head; redness of the face and eyes; inability to endure the light or any noise; watchfulness; a furious delirium, or typhomania.

I. Idiopathic.

II. Symptomatic.

Genus X. Cynanche. Pyrexia sometimes inclining to a typhus; difficulty of swallowing and breathing; with a sensation of narrowness in the fauces.

The species are,

I. Cynanche (tonsillaris) affecting the mucous membrane of the fauces, but especially the tonsils, with redness and swelling, accompanied with a synocha.

II. Cynanche (maligna) affecting the tonsils and mucous membrane of the fauces with swelling, redness, and mucous crusts of a whitish or ash-color, creeping, and covering ulcers; with a typhous fever and exanthemata.

III. Cynanche (trachealis) attended with difficult respiration, noisy and hoarse inspiration, loud cough, without any apparent tumor in the fauces, somewhat difficult deglutition, and a synocha.

IV. Cynanche (pharyngæa) attended with redness in the bottom of the fauces, very difficult and painful deglutition, respiration sufficiently free, and a synocha.

V. Cynanche (parotidæa) with great swelling in the parotids and maxillary glands appearing on the outside: the respiration and deglutition but little injured; a synocha, for the most part mild.

Diseases of this genus are symptomatic, either from external or internal causes.

Genus XI. Pneumonia. Pyrexia, with a pain in some part of the thorax, difficult respiration, and cough. The species are.

I. Peripneumony, with a pulse not always hard, but sometimes soft; an obtuse pain of the breast; the respiration always difficult; sometimes the patient cannot breathe unless in an upright posture; the face swelled, and of a livid color; the cough for the most part moist, frequently bloody.

1. Simple idiopathic peripneumonies.

Varying in degree.

2. Idiopathic peripneumonies complicated with fever.

3. Symptomatic peripneumonies

II. Pleurisy, with a hard pulse; for the most part attended with a pungent pain of one side augmented chiefly during the time of inspiration an uneasiness when lying on the side; a most painful cough, dry in the beginning of the disease, afterwards moist, and frequently bloody

1. Simple idiopathic pleurisies.

2. Pleurisies, complicated, 1. With fever. 2. With catarrh.

3. Symptomatic pleurisies.

4. False pleurisies.

The consequences of pleurisy are a vomica or empyema.

Genus XII. Carditis. Pyrexia; pain about the heart; anxiety; difficulty of breathing; cough; unequal pulse: palpitation of the heart, and fainting.

I. Idiopathic.

II. Symptomatic

Genus XIII. Peritonitis. Pyrexia; pain of the belly, exasperated by an upright posture,

without the proper signs of other abdominal phlegmasiæ.

I. Peritonitis (propria), situated in the peritonæum, properly so called, surrounding the inside of the abdomen.

II. Peritonitis (omentalis), in the peritonæum extended through the omentum.

III. Peritonitis (mesenterica), in the peritonæum spread through the mesentery.

Genus XIV. Gastritis. Pyrexia inclining to a typhus; anxiety; pain and heat of the epigastrium, augmented when any thing is taken into the stomach; an inclination to vomit, and an immediate rejection of every thing swallowed; an hiccough.

I. Idiopathic.

1. From internal causes.

A, Gastritis (phlegmonodæa), attended with acute pain and violent pyrexia.

2. From external causes.

B, Gastritis (erysipelatosa), with a less violent fever and pain: an erysipelatous redness appearing on the fauces.

II. Symptomatic.

Genus XV. Enteritis. Pyrexia of a typhous nature; pungent pain of the belly, stretching and twisting about the navel; vomiting; the belly obstinately bound.

I. Idiopathic.

1. Enteritis (phlegmonodæa), with acute pain, violent fever, vomiting, and constipation of the belly.

2. Enteritis (erysipelatosa), with less acute fever and pain, without vomiting; but accompanied with a diarrhœa.

II. Symptomatic.

Genus XVI. Hepatitis. Pyrexia; tension and pain of the right hypochondrium; sometimes pungent like that of a pleurisy, but more frequently obtuse; a pain reaching to the clavicle and top of the right shoulder; a difficulty of lying on the left side; dyspnœa; dry cough, vomiting, and hiccough.

Genus XVII. Splenitis. Pyrexia; tension, heat, and swelling of the left hypochondrium, the pain increasing by pressure; without the signs of nephritis.

Genus XVIII. Nephritis. Pyrexia; pain in the region of the kidney, often following the course of the ureter: frequent discharge of urine, either thin and colorless, or very red; vomiting; stupor of the thigh; with a retraction or pain of the testicle of the same side. The species are,

I. Idiopathic. Spontaneous.

II. Symptomatic.

Genus XIX. Cystitis. Pyrexia; pain and swelling of the hypogastrium: frequent and painful discharge of urine, or ischuria; and tenesmus. The species are,

I. Those arising from internal causes.

II. Those from external causes.

Genus XX. Hysteritis. Pyrexia; heat, tension, swelling, and pain of the hypogastrium; the os uteri painful when touched; vomiting.

Genus XXI. Rheumatismus. A disease arising from an external and frequently very evident cause; pyrexia; pain about the joints, frequently following the course of the muscles, infesting the knees and other large joints rather than those of the feet or hands; increased by external heat. The species are either idiopathic or symptomatic. The former varies in situation.

A, In the muscles of the loins.

B, In the muscles of the coxendix.

C, In the muscles of the breast.

Genus XXII. Odontalgia; a rheumatism of the jaws from a caries of the teeth.

Genus XXIII. Podagra. An hereditary disease, arising without any evident external cause, but for the most part preceded by an unusual affection of the stomach; pyrexia: pain of a joint, for the most part of the great toe of the foot, at last infesting chiefly the wrists and ancles; returning at intervals; and often alternated with affections of the stomach and other internal parts.

I. Podagra (regularis), with a pretty violent inflammation of the joints remaining for some days, and by degrees going off with swelling, itching, and desquamation of the affected part.

II. Podagra (atonica), with an atony of the stomach, or some other internal part; and either without the usual inflammation of the joints, or only with slight and wandering pains; and frequently alternated with dyspepsia, or other symptoms of atony.

III. Podagra (retrograda), with the inflammation of the joints suddenly disappearing, and an atony of the stomach and other parts immediately following.

IV. Podagra (aberrans), with the inflammation of an internal part either preceding or not, and suddenly disappearing.

Genus XXIV. Arthropuosis. Deep, obtuse, and long-continued pains of the joints or muscular parts, frequently following contusions; with either no swelling, or a moderate and diffused one; no phlogosis; pyrexia, at first gentle, afterwards hectic, and at length an imposthume.

Order III. Exanthemata. Contagious diseases; affecting a person only once in his life; beginning with fever; after a certain time appear phlogoses, for the most part small and in considerable number, and dispersed over the skin.

Genus XXV. Erysipelas. A synocha of two or three days, for the most part attended with drowsiness, often with a delirium. In some parts of the skin, most frequently the face, appears a phlogosis. The species are,

I. Erysipelas (vesiculosum), with erythema, redness creeping, occupying a large space, and in some parts ending in large blisters.

II. Erysipelas (phlyctænodes), with an erythema formed of a number of papulæ, chiefly occupying the trunk of the body, ending in phlyctenæ or small blisters.

The disease is also symptomatic.

Genus XXVI. Pestis. An exceedingly contagious typhus, with the highest debility. On an uncertain day of the disease buboes and carbuncles break forth. It is various in degree, but the species are uncertain.

Genus XXVII. Variola; a contagious synocha, with vomiting, and pain on pressing the epigastrium. On the third day begins, and on the fifth is finished, the eruption of inflammatory pustules, which suppurate in the space of eight days, and at last go off in crusts; frequently leaving depressed cicatrices or pockpits in the skin. The species are,

I. Variola (discreta), with few, distinct, turgid pustules, having circular bases; the fever ceasing immediately after the eruption.

II. Variola (confluens), with numerous, confluent irregularly-shaped pustules, flaccid, and little elevated; the fever remaining after the eruption.

Genus XXVIII. Varicella. Synocha; papulæ breaking out after a short fever, similar to those of the small-pox, but hardly ever coming to suppuration; after a few days going off in small scales, without leaving any mark.

Genus XXIX. Rubeola. A contagious synocha, with sneezing, epiphora, and dry hoarse cough. On the fourth day, or a little later, break forth small, clustered, and scarcely elevated papulæ; after three days going off in very small branny scales.

I. Rubeola (vulgaris), with very small confluent corymbose papulæ, scarcely rising above the skin.

Varying,

1. In the symptoms being more severe, and the course of the disease less regular.

2. In being accompanied with a cynanche.

3. With a putrid diathesis.

II. Rubeola (variolodes), with distinct papulæ raised above the skin.

Genus XXX. Miliaria. Synochus with anxiety, frequent sighing, unctuous sweat, and a sense of pricking as of pin points in the skin. On an uncertain day of the disease break out red, small, distinct papulæ, spread over the whole body as well as the face; the apices of which, after one or two days, become very small white pustules, remaining for a short time.

Genus XXXI. Scarlatina. A contagious synocha. On the fourth day of the disease the face swells a little; at the same time a universal redness occupies the skin in large spots, at length running together; after three days going off in branny scales; frequently succeeded by an anasarca. The species are,

I. Scarlatina (simplex), not accompanied with cynanche.

II. Scarlatina (cynanchica), with an ulcerous cynanche.

Genus XXXII. Urticaria. A quotidian fever. On the second day of the disease red spots resembling the stinging of nettles, almost vanishing during the day, but returning in the evening with the fever, and after a few days going off altogether in very small scales.

Genus XXXIII. Pemphigus. A contagious typhus. On the first, second, or third day of the disease, blisters break out in several parts of the body, of the bigness of a bean, remaining for many days, and at last pouring out a thin ichor.

Genus XXXIV. Aphtha. Synochus; the tongue somewhat swelled and of a livid color, as well as the fauces; eschars first appearing in the fauces, but at length occupying the whole internal parts of the mouth, of a white color, sometimes distinct, often running together; quickly growing again when taken off, and remaining for an uncertain time.

The species are, 1. Idiopathic. 2. Symptomatic.

Order IV. Hæmorrhagiæ. Pyrexia, with a discharge of blood, without any external violence: the blood drawn from a vein hath the same appearance as in phlegmasiæ.

Genus XXXV. Epistaxis. Pain or weight of the head, redness of the face; a discharge of blood from the nose.

I. Idiopathic.

Varying according to the time of life.

1. Epistaxis of young people, with symptoms of an arterial plethora.

2. Epistaxis of old people, with symptoms of a venous plethora.

II. Symptomatic.

1. From internal causes.

2. From external causes.

Genus XXXVI. Hæmoptysis. Redness of the cheeks; a sensation of uneasiness, or pain, and sometimes of heat in the breast: difficulty of breathing; tickling of the fauces; either a severe or less violent cough, bringing up florid and frequently frothy blood.

The idiopathic species are,

1. Hæmoptysis (plethorica), without any external violence, and without being preceded by any cough or suppression of any customary evacuation.

2. Hæmoptysis (violenta), from external violence applied.

3. Hæmoptysis (phthisica), after a long continued cough, with a leanness and debility.

4. Hæmoptysis (calculosa), in which some calculous molecules, for the most part of a calcareous nature, are thrown up.

6. Hæmoptysis (vicaria), after the suppression of a customary evacuation.

Besides these, there are a number of symptomatic species mentioned by different authors. The consequence of an hæmoptysis is, a

Phthisis. A wasting and debility of the body, with a cough, hectic fever, and for the most part a purulent expectoration. The species are,

I. An incipient phthisis, without any expectoration of pus.

II. A confirmed phthisis, with an expectoration of pus.

Both species vary, 1. As to their remote cause. 2. As to the origin of the purulent matter.

Genus XXXVII. Hæmorrhois. Weight and pain of the head; vertigo; pain of the loins; pain of the anus; livid painful tubercles, from which for the most part blood flows out; which sometimes also drops out of the anus, without any apparent tumor. The species are,

1. Hæmorrhois (tumens), external from mariscæ.

Varying,

A, Bloody.

B, Mucous.

2. Hæmorrhois (procidens), external from a procidentia ani.

3. Hæmorrhois (fluens), internal, without any swelling, or procidentia ani.

4. Hæmorrhois (cæca), with pain and swelling of the anus, without any profusion of blood.

Genus XXXVIII. Menorrhagia. Pains of the back, belly, and loins, like those of childbirth; an unusually copious flux of the menses or blood from the vagina. The species are,

1. Menorrhagia (rubra), bloody in women neither with child nor in child-birth.

2. Menorrhagia (abortus), bloody in women with child.

3. Menorrhagia (lochialis), bloody in women after delivery.

4. Menorrhagia (vitiorum), bloody from some local disease.

5. Menorrhagia (alba), serous, without any local disease, in women not pregnant.

6. Menorrhagia (nabothi), serous in women with child.

Order V. PROFLUVIA. Pyrexia, with an increased excretion, naturally not bloody.

Genus XXXIX. Catarrhus. Pyrexia frequently contagious; an increased excretion of mucus, at least efforts to excrete it.

The species are,

1. From cold.

2. From contagion.

Genus XL. Dysenteria. Contagious pyrexia; frequent mucous or bloody stools, while the alvine fæces are for the most part retained; gripes; tenesmus.

Varying,

1. Accompanied with worms.

2. With the excretion of small fleshy or sebaceous bodies.

3. With an intermittent fever.

4. Without blood.

5. With a miliary fever.

Class II. NEUROSES. A preternatural affection of sense and motion, without an idiopathic pyrexia, or any local affection.

Order I. COMATA. A diminution of voluntary motion, with sleep, or a deprivation of the senses.

Genus XLI. Apoplexia. Almost all voluntary motion abolished, with sleep more or less profound; the motion of the heart and arteries remaining.

The idiopathic species are,

1. Apoplexia (sanguinea), with symptoms of universal plethora, especially of the head.

2. Apoplexia (serosa), with a leucophlegmatia over the whole body, especially in old people.

3. Apoplexia (hydrocephalica), coming on by degrees; affecting infants, or those below the age of puberty, first with lassitude, a slight fever, and pain of the head, then slowness of the pulse, dilatation of the pupil of the eye, and drowsiness.

4. Apoplexia (atrabiliaria), taking place in those of a melancholic constitution.

5. Apoplexia (traumatica), from some external injury mechanically applied to the head.

6. Apoplexia (venenata), from powerful sedatives taken internally, or applied externally.

7. Apoplexia (mentalis), from an affection or emotion of the mind.

8. Apoplexia (cataleptica), the muscles remaining contractile, by external motion of the limbs.

2. Apoplexia (suffocata), from some external suffocating power.

The apoplexy is frequently symptomatic.

1. Of an intermittent fever. 2. Continued fever. 3. Phlegmasia. 4. Exanthema. 5. Hysteria. 6. Epilepsia. 7. Podagra. 8. Worms. 9. Ischuria. 10. Scurvy.

Genus XLII. Paralysis. Only some of the voluntary motions impaired, frequently with sleep.

The idiopathic species are,

1. Paralysis (partialis), of some particular muscles only.

2. Paralysis (hemiplegica), of one side of the body.

Varying according to the constitution of the body.

a, Hemiplegia in a plethoric habit.

b, In a leucophlegmatic habit.

3. Paralysis (paraplegica), of one-half of the body taken transversely.

4. Paralysis (venenata), from sedative powers applied either internally or externally.

A symptom either of an asthenia or palsy is,

Tremor; an alternate motion of a limb by frequent strokes and intervals.

The species are, 1. Asthenic. 2. Paralytic. 3. Convulsive.

Order II. ADYNAMIÆ. A diminution of the involuntary motions, whether vital or natural.

Genus XLIII. Syncope; a diminution or even a total stoppage, of the motion of the heart for a short time.

I. Idiopathic.

1. Syncope (cardiaca), returning frequently without any manifest cause, with violent palpitations of the heart during the intervals. From a fault of the heart or neighbouring vessels.

2. Syncope (occasionalis), arising from some evident cause. From an affection of the whole system.

II. Symptomatic; of diseases either of the whole system, or of other parts besides the heart.

Genus XLIV. Dyspepsia. Anorexia, nausea, vomiting, inflation, eructation, rumination, cardialgia, gastrodynia, more or fewer of those symptoms at least concurring; for the most part with a constipation of the belly, and without any other disease either of the stomach itself or of other parts.

I. Idiopathic.

II. Symptomatic.

1. From a disease of the stomach itself.

2. From a disease of other parts, or of the whole body.

Genus XLV. Hypochondriasis. Dyspepsia, with languor, sadness, and fear, without any adequate causes, in a melancholy temperament.

Genus XLVI. Chlorosis. Dyspepsia, or a desire of something not used as food; a pale or discolored complexion; the veins not well filled: a soft tumor of the whole body; asthenia; palpitation; suppression of the menses.

Order III. SPASMI. Irregular motions of the muscles or muscular fibres.

Sect. I. *In the animal functions.*

Genus XLVII. Tetanus. A spastic rigidity of almost the whole body.

Varying according to the remote cause, as it rises either from something internal, from cold, or from a wound. It varies likewise, from whatever cause it may arise, according to the part of the body affected.

Genus XLVIII. Trismus. A spastic rigidity of the lower jaw. The species are,

1. Trismus (nascentium), attacking infants under two months old.

2. Trismus (traumaticus), attacking people of all ages, either from a wound or cold.

Genus XLIX. Convulsio. An irregular clonic contraction of the muscles without sleep.

I. Idiopathic.

II. Symptomatic.

Genus L. Chorea, attacking those who have not yet arrived at puberty, most commonly within the tenth or fourteenth year, with convulsive motions for the most part of one side in attempting the voluntary motion of the hands and arms, resembling the gesticulations of mountebanks; in walking, rather dragging one of their feet than lifting it.

Genus LI. Raphania. A spastic contraction of the joints, with a convulsive agitation, and most violent periodical pain.

Genus LII. Epilepsia. A convulsion of the muscles, with sleep.

The idiopathic species are,

1. Epilepsia (cerebralis), suddenly attacking without any manifest cause, without any sense of uneasiness preceding, excepting perhaps a slight vertigo or dimness of sight.

2. Epilepsia (sympathica), without any manifest cause, but preceded by the sensation of a kind of air rising from a certain part of the body towards the head.

3. Epilepsia (occasionalis), arising from a manifest irritation, and ceasing on the removal of that irritation.

Varying according to the difference of the irritating matter. And thus it may arise,

From injuries of the head, pain, worms, poison; from the repulsion of the itch, or an effusion of any other acrid humor; from crudities in the stomach; from passions of the mind; from an immoderate hæmorrhagy, or from debility.

Sect. II. *In the vital functions.*

In the action of the heart.

Genus LIII. Palpitatio. A violent and irregular motion of the heart.

In the action of the lungs.

Genus LIV. Asthma. A difficulty of breathing returning by intervals, with a sense of straitness in the breast, and a noisy respiration with hissing. In the beginning of the paroxysm there is either no cough at all, or coughing is difficult; but, towards the end, the coughing becomes free, frequently with a copious spitting of mucus. The idiopathic species are,

1. Asthma (spontaneum), without any manifest cause or other concomitant disease.

2. Asthma (exanthematicum), from the repulsion of the itch or other acrid effusion.

3. Asthma (plethoricum), from the suppression of some customary sanguineous evacuation, or from a spontaneous plethora.

Genus LV. Dyspnœa. A continual difficulty of breathing, without any sense of straitness, but rather of fullness and infarction in the breast; a frequent cough throughout the whole course of the disease.

The idiopathic species are,

1. Dyspnœa (catarrhalis), with a frequent cough, bringing up plenty of viscid mucus.

2. Dyspnœa (sicca), with a cough for the most part dry.

3. Dyspnœa (aërea), increased by the least change of weather.

4 Dyspnœa (terrea), bringing up with the cough an earthy or calculous matter.

5. Dyspnœa (aquosa), with scanty urine and œdematous feet; without any fluctuation in the breast, or other signs of an hydrothorax.

6. Dyspnœa (pinguedinosa), in very fat people.

7. Dyspnœa (thoracica), from an injury done to the parts surrounding the thorax, or from some malconformation of them.

8. Dyspnœa (extrinseca), from evident external causes.

The symptomatic species of dyspnœa are consequences,

1. Of diseases of the heart or large vessels.

2. Of a swelling in the abdomen.

3. Of various other diseases.

Genus LVI. Pertussis. A contagious disease; convulsive strangulating cough reiterated with noisy inspiration; frequent vomiting.

Sect. III. *In the natural functions.*

Genus LVII. Pyrosis. A burning pain in the epigastrium, with plenty of aqueous humor, for the most part insipid, but sometimes acrid, belched up.

Genus LVIII. Colica. Pain of the belly, especially twisting round the navel; vomiting; and a constipation.

The idiopathic species are,

1. Colica (spasmodica), with retraction of the navel, and spasms of the abdominal muscles.

Varying, by reason of some symptoms superadded. Hence,

a, Colica, with vomiting of excrements, or of matters injected by the anus.

b, Colica, with inflammation supervening.

2. Colica (pictonum), preceded by a sense of weight or uneasiness in the belly, especially about the navel; then comes on the colic pain, at first slight and interrupted, chiefly augmented after meals; at length more severe and almost continual, with pains of the arms and back; at last ending in a palsy.

Varying according to the nature of the remote cause; and hence,

a, From metallic poison.

b, From acids taken inwardly.

c, From cold.

d, From a contusion of the back.

3. Colica (stercorea), in people subject to costiveness.

4. Colica (accidentalis), from acrid matter taken inwardly.

5. Colica (meconialis), in new-born children from a retention of the meconium.

6. Colica (callosa), with a sensation of stricture in some part of the intestines, and frequently of a collection of flatus with some pain: which flatus also passing through the part where the stricture is felt, gradually vanishes; the belly slow, and at last passing only a few liquid fæces.

7. Colica (calculosa), with a fixed hardness in some part of the abdomen, and calculi sometimes passed by the anus.

Genus LIX. Cholera. A vomiting of bilious matter, and likewise a frequent excretion of the same by stool; anxiety; gripes; spasms in the calves of the legs.

I. Idiopathic.

1. Cholera (spontanea), arising in a warm season, without any manifest cause.

2. Cholera (accidentalis), from acrid matters taken inwardly.

II. Symptomatic.

Genus LX. Diarrhœa. Frequent stools; the disease not infectious; no primary pyrexia.

I. Idiopathic.

1. Diarrhœa (crapulosa), in which the excrements are voided in greater quantity than naturally.

2. Diarrhœa (biliosa), in which yellow fæces are voided in great quantity.

3. Diarrhœa (mucosa) in which either from acrid substances taken inwardly, or from cold, especially applied to the feet, a great quantity of mucus is voided.

4. Diarrhœa (cœliaca), in which a milky humor of the nature of chyle is discharged by stool.

5. Diarrhœa (lienteria), in which the aliments are discharged with little alteration soon after eating.

6. Diarrhœa (hepatirrhœa), in which a bloody serous matter is discharged without pain.

II. Symptomatic.

Genus LXI. Diabetes. A chronical profusion of urine, for the most part preternatural, and in immoderate quantity.

I. Idiopathic.

1. Diabetes (mellitus), with urine of the smell, color, and taste of honey.

2. Diabetes (insipidus), with limpid, but not sweet, urine.

II. Symptomatic.

Genus LXII. Hysteria. Rumbling of the bowels; a sensation as of a globe turning itself in the belly, ascending to the stomach and fauces, and there threatening suffocation; sleep; convulsions; a great quantity of limpid urine; the mind involuntarily fickle and mutable.

The following are by Sauvages reckoned distinct idiopathic species; but by Dr. Cullen only varieties of the same species

A, From a retention of the menses.

B, From a menorrhagia cruenta.

C, From a menorrhagia serosa, or fluor albus.

D, From an obstruction of the viscera.

E, From a fault of the stomach.

F, From too great salacity.

Genus LXIII. Hydrophobia. A dislike and horror at any kind of drink, as occasioning a convulsion of the pharynx; induced for the most part by the bite of a mad animal. The species are,

1. Hydrophobia (rabiosa), with a desire of biting the bystanders, occasioned by the bite of a rabid animal.

II. Hydrophobia (simplex), without madness, or any desire of biting

Order IV. Vesaniæ. Disorders of the judgment, without any pyrexia or coma.

Genus LXIV. Amentia; an imbecility of judgment, by which people either do not perceive, or do not remember, the relations of things. The species are,

I. Amentia (congenita), continuing from birth.

II. Amentia (senilis), from the diminution of the perceptions and memory through extreme old

III. Amentia (acquisita), occurring in people formerly of a sound mind, from evident external causes.

Genus LXV. Melancholia; a partial madness, without dyspepsia.

Varying according to the different subjects concerning which the person raves; and thus it is,

1. With an imagination in the patient concerning his body being in a dangerous condition, from slight causes; or his affairs in a desperate state.

2. With an imagination concerning a prosperous state of affairs.

3. With violent love, without satyriasis or nymphomania.

4. With a superstitious fear of a future state.

5. With an aversion from motion and all the offices of life.

6. With restlessness, and an impatience of any situation whatever.

7. With a weariness of life.

1. With a deception concerning the nature of the patient's species,

Dr. Cullen thinks that there is no such disease as that called dæmonomania, and that the diseases mentioned by Sauvages under that title are either,

1. Species of melancholy or mania; or

2. Of some disease by the spectators falsely ascribed to the influence of an evil spirit; or

3. Of a disease entirely feigned; or

4. Of a disease partly true and partly feigned.

Genus LXVI. Mania; universal madness.

1. Mania (mentalis), arising entirely from passions of the mind.

2. Mania (corporea), from an evident disease of the body.

Varying according to the different disease of the body.

3. Mania (obscura), without any passion of mind or evident disease of the body preceding.

The symptomatic species of mania are,

1. Paraphrosyne from poisons.

2. Paraphrosyne from passion.

3. Paraphrosyne febrilis.

Genus LXVII. Oneirodynia. A violent and troublesome imagination in time of sleep.

1. Oneirodynia (activa), exciting to walking and various motions.

2. Oneirodynia (gravans), from a sense of some weight incumbent, and pressing on the breast especially.

Class III. CACHEXIÆ; a depraved habit of the whole or greatest part of the body, without primary pyrexia or neurosis.

Order I. Marcores; emaciation of the whole body.

Genus LXVIII. Tabes. Leanness, asthenia, hectic fever. The species are,

1. Tabes (purulenta), from an external or internal ulcer, or from a vomica.

Varying in its situation; hence,

2. Tabes (scrofulosa), in scrofulous constitutions.

3. Tabes (venenata), from poison taken inwardly.

Genus LXIX. Atrophia. Leanness and asthenia, without hectic fever The species are,

1. Atrophia (inanitorum), from too great evacuation.

2. Atrophia (famelicorum), from a want of nourishment.

3. Atrophia (cacochymica), from corrupted nourishment.

4. Atrophia (debilium), from the function of nutrition being depraved, without any extraordinary evacuation or cacochymia having preceded.

Order II. Intumescentiæ. An external swelling of the whole or greatest part of the body.

Sect. I. *Adiposæ*.

Genus LXX. Polysarcia; a troublesome swelling of the body from fat.

Sect. II. *Flatuosæ*.

Genus LXXI. Pneumatosis; a tense elastic swelling of the body, crackling under the hand The species are,

1. Pneumatosis (spontanea), without any manifest cause.

2. Pneumatosis (traumatica), from a wound in the breast.

3. Pneumatosis (veneneta), from poison injected or applied.

4. Pneumatosis (hysterica), with hysteria.

Genus LXXII. Tympanites; a tense, elastic, sonorous swelling of the abdomen; costiveness; a decay of the other parts. The species are,

1. Tympanites (intestinalis), with a tumor of the abdomen frequently unequal, and with a frequent evacuation of air relieving the tension and pain.

2. Tympanites (abdominalis) with a more evident noise, a more equable tumor, and a less frequent emission of flatus, which also gives less relief.

Genus LXXIII. Physometra; a slight elastic swelling in the epigastrium, having the figure and situation of the uterus.

Sect. III. *Aquosæ* or *Dropsies*.

Genus LXXIV. Anasarca. A soft, inelastic swelling of the whole body, or some part of it. The species are,

1. Anasarca (serosa), from a retention of serum on account of the suppression of the usual evacuations, or from an increase of the serum on account of too great a quantity of water taken inwardly.

2. Anasarca (oppilata), from a compression of the veins.

3. Anasarca (exanthematica), arising after exanthemata, especially succeeding erysipelas.

4. Anasarca (anæmia), from the thinness of the blood produced by hæmorrhagy.

5. Anasarca (debilium), in weak people after long diseases, or from other causes.

Genus LXXV. Hydrocephalus. A soft inelastic swelling of the head, with the sutures of the cranium opened.

Genus LXXVI. Hydrorachitis. A soft, slender tumor above the vertebræ of the loins; the vertebræ gaping from each other.

Genus LXXVII. Hydrothorax. Dyspnœa; paleness of the face; œdematous swellings of the feet; scanty urine; difficult lying in a recumbent posture; a sudden and spontaneous starting out of sleep, with palpitation; water fluctuating in the breast.

Genus LXXVIII. Ascites. A tense, scarce elastic, but fluctuating swelling of the abdomen. The species are,

1. Ascites (abdominalis), with an equal swelling of the whole abdomen, and with a fluctuation sufficiently evident.

Varying according to the cause.

A, From an obstruction of the viscera.

B, From debility.

C, From a thinness of the blood.

2. Ascites (saccatus), with a swelling of the abdomen, in the beginning at least, partial, and with a less evident fluctuation.

Genus LXXIX. Hydrometra. A swelling of the hypogastrium in women, gradually increasing, keeping the shape of the utorus, yielding to pressure, and fluctuating; without ischuria or pregnancy.

Genus LXXX. Hydrocele. A swelling of the scrotum, not painful; increasing by degrees, soft, fluctuating, and pellucid.

Sect. IV. *Solidæ*.

Genus LXXXI. Physconia. A swelling chiefly occupying a certain part of the abdomen, gradually increasing, and neither sonorous nor fluctuating. The species are

Physconia hepatica.
Physconia splenica.
Physconia renalis.
Physconia uterina.
Physconia ab ovario.
Physconia mesenterica.
Physconia intestinalis.
Physconia omentalis.
Physconia polysplachna.
Physconia visceralis.
Physconia externa lupialis.
Physconia externa schirrhodea.
Physconia externa hydatidosa.
Physconia ab adipe subcutaneo.
Physconia ab excrescentia.

Genus LXXXII. Rachitis. A large head swelling most in the fore part, the ribs depressed, abdomen swelled, with a decay of the other parts.

Varying,

1. Simple, without any other disease.

2. Joined with other diseases.

Order III. Impetigines. Cachexies chiefly deforming the skin and external parts of the body.

Genus LXXXIII. Scrofula. Swellings of the conglobate glands, especially in the neck: swelling of the upper lip and of the nose; the face florid, skin thin, abdomen swelled. The species are,

1. Scrofula (vulgaris), simple, external, and permanent.

2. Scrofula (mesenterica), simple, internal, with paleness of the face, want of appetite, swelling of the abdomen, and unusual fetor of the excrements.

3. Scrofula (fugax), most simple, appearing only about the neck; for the most part proceeding from the resorption of the matter of ulcers in the head.

4. Scrofula (Americana), joined with the yaws.

Genus LXXXIV. Syphilis. A contagious disease; ulcers of the tonsils, after impure venery, and a disorder of the genitals; clustered

pimples of the skin, especially about the margin of the hair, ending in crusts and crusty ulcers; pains of the bones; exostoses.

Genus LXXXV. Scorbutus; in cold countries attacking after putrescent diet, especially such as is salt and of the animal kind, where no supply of fresh vegetables is to be had; asthenia; stomacace; spots of different colors on the skin, for the most part livid, and appearing chiefly among the roots of the hair.

Varying in degree.

a, Scorbutus incipiens.

b, Scorbutus crescens.

c, Scorbutus inveteratus.

Varying also in symptoms.

d, Scorbutus lividus.

e, Scorbutus petechialis.

f, Scorbutus pallidus.

g, Scorbutus ruber.

h, Scorbutus calidus.

Genus LXXXVI. Elephantiasis; a contagious disease: thick, wrinkled, rough, unctuous skin, destitute of hairs, anæsthesia in the extremities, the face deformed with pimples, the voice hoarse and nasal.

Genus LXXXVII. Lepra; the skin rough, with white, branny, and chopped eschars, sometimes moist beneath, with itching.

Genus LXXXVIII. Frambœsia; swellings resembling fungi, or the fruit of the mulberry or raspberry, growing on various parts of the skin.

Genus LXXXIX. Trichoma; a contagious disease; the hairs thicker than usual, and twisted into inextricable knots and cords.

Genus XC. Icterus; yellowness of the skin and eyes; white fæces; urine of a dark red, tinging what is put into it of a yellow color.

The idiopathic species are,

1. Icterus (calculosus), with acute pain in the epigastric region, increasing after meals; biliary concretions voided by stool.

2. Icterus (spasmodicus), without pain after spasmodic diseases and passions of the mind.

3. Icterus (hepaticus), without pain, after diseases of the liver.

4. Icterus (gravidarum), arising during the time of pregnancy, and going off after delivery.

5. Icterus (infantum), coming on in infants a few days after birth.

Class IV. LOCALES. An affection of some part, but not of the whole body.

Order I. Dysæsthesiæ. The senses depraved or destroyed, from a disease of the external organs.

Genus XCI. Caligo. The sight impaired or totally destroyed, on account of some opaque substance interposed between the objects and the retina, inherent in the eye itself or the eyelids. The species are,

1. Caligo (lentis), occasioned by an opaque spot behind the pupil.

2. Caligo (corneæ), from an opacity of the cornea.

3. Caligo (pupillæ), from an obstruction of the pupil.

Varying according to the different causes from which it proceeds.

4. Caligo (humorum), from a disease or defect of the aqueous humor.

Varying according to the different state of the humor.

5. Caligo (palpebrarum) from a disease inherent in the eyelids.

Varying according to the nature of the disease in the eyelids.

Genus XCII. Amaurosis. The sight diminished, or totally abolished, without any evident disease of the eye; the pupil for the most part remaining dilated and immoveable. The species are,

1. Amaurosis (compressionis), after the causes and attended with the symptoms of congestion in the brain.

Varying according to the nature of the remote cause.

2. Amaurosis (atonica), after the causes and accompanied with symptoms of debility.

3. Amaurosis (spasmodica), after the causes and with the signs of spasm.

4. Amaurosis (venenata), from poison taken into the body or applied outwardly to it.

Genus XCIII. Dysopia. A depravation of the sight, so that objects cannot be distinctly perceived, except at a certain distance, and in a certain situation.

The species are,

1. Dysopia (tenebrarum), in which objects are not seen unless they be placed in a strong light.

2. Dysopia (luminis), in which objects are not distinctly seen unless by a weak light.

3. Dysopia (dissitorum), in which distinct objects are not perceived.

4. Dysopia (proximorum), in which the nearest objects are not perceived.

5. Dysopia (lateralis), in which objects are not perceived unless placed in an oblique posture.

Genus XCIV. Pseudoblepsis; when the sight is diseased in such a manner that the person imagines he sees things which really do not exist, or sees things which do exist after some other manner than they really are. The species are,

1. Pseudoblepsis (imaginaria), in which the person imagines he sees things which really do not exist.

Varying according to the nature of the imagination.

2. Pseudoblepsis (mutans), in which objects really existing appear somehow changed.

Varying according to the change perceived in the objects, and according to the remote cause.

Genus XCV. Dysecœa. A diminution or total abolition of the sense of hearing. The species are,

1. Dysecœa (organica), from a disease in the organs transmitting sounds to the internal ear.

Varying according to the nature of the disease and of the part affected.

2. Dysecœa (atonica), without any evident disease of the organs transmitting the sounds.

Varying according to the nature of the cause.

Genus XCVI. Paracusis: a depravation of the hearing. The species are,

1. Paracusis (imperfecta), in which, though sounds coming from external objects are heard, yet it is neither distinctly nor in the usual manner.

Varying,

a, With a dulness of hearing.

b, With a hearing too acute and sensible.

c, When a single external sound is doubled by some internal causes.

d, When the sounds which a person desires to hear are not perceived, unless some other violent sound is raised at the same time.

2. Paracusis (imaginaria), in which sounds not existing externally are excited from internal causes.

Varying according to the nature of the sound perceived, and according to the nature of the remote cause.

Genus XCVII. Anosmia; a diminution or abolition of the sense of smell. The species are,

1. Anosmia (organica), from a disease in the membrane lining the internal parts of the nostrils.

Varying according to the nature of the disease.

2. Anosmia (atonica), without any evident disease of the membrane of the nose.

Genus XCVIII. Agheustia; a diminution or abolition of the sense of taste.

1. Agheustia (organica), from a disease in the membrane of the tongue, keeping off from the nerves those substances which ought to produce taste.

2. Agheustia (atonica), without any evident disease of the tongue.

Genus XCIX. Anæsthesia; a diminution or abolition of the sense of feeling. The species from Sauvages, adopted by Dr. Cullen, are,

1. Anæsthesia à spina bifida.
2. Anæsthesia plethorica.
3. Anæsthesia nascentium.
4. Anæsthesia melancholica.

Order II. Dysorexiæ; error or defect of appetite.

Sect. I. *Appetitus erronei.*

Genus C. Bulimia; a desire for food in greater quantities than can be digested.

The idiopathic species are,

1. Bulimia (helluonum), an unusual appetite for food, without any disease of the stomach.

2. Bulimia (syncopalis), a frequent desire of meat, on account of a sensation of hunger threatening syncope.

3. Bulimia (emetica), an appetite for a great quantity of meat, which is thrown up immediately after it is taken.

Genus CI. Polydipsia; an appetite for an unusual quantity of drink.

The polydipsia is almost always symptomatic, and varies only according to the nature of the disease which accompanies it.

Genus CII. Pica; a desire of swallowing substances not used as food.

Genus CIII. Satyriasis; an unbounded desire of venery in men. The species are,

1. Satyriasis (juvenilis), an unbounded desire of venery, the body at the same time being little disordered.

2. Satyriasis (furens), a vehement desire of venery with a great disorder of the body at the same time.

Genus CIV. Nymphomania; an unbounded desire of venery in women.

Varying in degree.

Genus CV. Nostalgia; a violent desire of those who are absent from their country of revisiting it.

1. Nostalgia (simplex), without any other disease.

2. Nostalgia (complicata), accompanied with other diseases.

Sect. II. *Appetitus deficientes.*

Genus CVI. Anorexia. Want of appetite for food. Always symptomatic.

1. Anorexia (humoralis), from some humor loading the stomach.

2. Anorexia (atonica), from the tone of the fibres of the stomach being lost.

Genus CVII. Adipsia; a want of desire for drink. Always a symptom of some disease affecting the sensorium commune.

Genus CVIII. Anaphrodisia; want of desire for, or impotence to, venery.

The true species are,

1. Anaphrodisia paralytica.
2. Anaphrodisia gonorrhoica.

The false ones are,

1. Anaphrodisia à mariscis.
2. Anaphrodisia ab urethræ vitio.

Order III. Dyscinesiæ. An impediment, or depravation of motion from a disorder of the organs.

Genus CIX. Aphonia; a total suppression of voice without coma or syncope. The species are,

1. Aphonia (gutturalis), from the fauces or glottis being swelled.

2. Aphonia (trachealis), from a compression of the trachea.

3. Aphonia (atonica), from the nerves of the larynx being cut.

Genus CX. Mutitas; a want of power to pronounce words. The species are,

1. Mutitas (organica), from the tongue being cut out or destroyed.

2. Mutitas (atonica), from injuries done to the nerves of the tongue.

3. Mutitas (surdorum), from people being born deaf, or the hearing being destroyed during childhood.

Genus CXI. Paraphonia; a depraved sound of the voice. The species are,

1. Paraphonia (puberum), in which, about the time of puberty, the voice from being acute and sweet, becomes more grave and harsh.

2. Paraphonia (rauca), in which, by reason of the dryness or flaccid tumor of the fauces, the voice becomes rough and hoarse.

3. Paraphonia (resonans), in which, by reason of an obstruction of the nostrils, the voice becomes hoarse, with a sound hissing through the nostrils.

4. Paraphonia (palatina), in which, on account of a defect or division of the uvula, for the most part with a hare-lip, the voice becomes obscure, hoarse, and unpleasant.

5. Paraphonia (clangens), in which the voice is changed to one acute, shrill, and small.

6. Paraphonia (comatosa), in which, from a relaxation of the velum palati and glottis, a sound is produced during inspiration.

Genus CXII. Psellismus; a defect in the articulation of words. The species are,

1. Psellismus (hæsitans), in which the words, especially the first ones of a discourse, are not easily pronounced, and not without a frequent repetition of the first syllable.

2. Psellismus (ringens), in which the sound of the letter R is always aspirated, and, as it were, doubled.

3. Psellismus (lallans), in which the sound of the letter L becomes more liquid, or is pronounced instead of R.

4. Psellismus (emolliens), in which the hard letters are changed into the softer ones, and thus the letter S is much used.

5. Psellismus (balbutiens), in which, by reason of the tongue being large, or swelled, the labial letters are better heard, and often pronounced instead of others.

6. Psellismus (acheilos), in which the labial letters cannot be pronounced at all, or with difficulty.

7. Psellismus (lagostomatum), in which, on account of the division of the palate, the guttural letters are less perfectly pronounced.

Genus CXIII. Strabismus; the optic axes of the eyes not converging. The species are,

1. Strabismus (habitualis), from a bad custom of using only one eye.

2. Strabismus (commodus), from the greater debility or mobility of one eye above the other; so that both eyes cannot be conveniently used.

3. Strabismus (necessarius), from a change in the situation or shape of the parts of the eye.

Genus CXIV. Dysphagia; impeded deglutition, without phlegmasia, or the respiration being affected.

Genus CXV. Contractura; a long-continued and rigid contraction of one or more limbs. The species are,

1. Contractura (primaria), from the muscles becoming contracted and rigid.

a, From the muscles becoming rigid by inflammation.

b, From muscles becoming rigid by spasm.

c, From muscles contracted by reason of their antagonists having become paralytic.

d, From muscles contracted by an irritating acrimony.

2. Contractura (articularis), from stiff joints.

Order IV. Apocenosis. A flux either of blood or some other humor flowing more plentifully than usual, without pyrexia, or an increased impulse of fluids.

Genus CXVI. Profusio; a flux of blood.

Genus CXVII. Ephidrosis; a preternatural evacuation of sweat.

Symptomatic ephidroses vary according to the nature of the diseases which they accompany, the different nature of the sweat itself, and sometimes the different parts of the body which sweat most.

Genus CXVIII. Epiphora; a flux of the lachrymal humor.

Genus CXIX. Ptyalismus; a flux of saliva.

Genus CXX. Enuresis; an involuntary flux of urine without pain. The species are,

1. Enuresis (atonica), after diseases injuring the sphincter of the bladder.

2. Enuresis (irritata), from a compression or irritation of the bladder.

Genus CXXI. Gonorrhœa; a preternatural flux of humor from the urethra in men, with or without a desire of venery. The species are,

1. Gonorrhœa (pura), in which, without any impure venery having preceded, a fluid resembling pus, without dysuria or propensity to venery, flows from the urethra.

2. Gonorrhœa (impura), in which, after impure vereny, a fluid like pus flows from the urethra with dysuria. The consequence of this is,

Gonorrhœa (mucosa), in which, after an impure gonorrhœa, a mucous humor flows from the urethra with little or no dysuria.

3. Gonorrhœa (laxorum), in which a humor for the most part pellucid, without any erection of the penis, but with a propensity to venery, flows from the urethra while the person is awake.

4. Gonorrhœa (dormientium), in which the seminal liquor is thrown out, with erection and desire of venery, in those who are asleep and have lascivious dreams.

Order V. Epischeses; suppressions of evacuations.

Genus CXXII. Obstipatio; the stools either suppressed, or slower than usual. The species are,

1. Obstipatio (debilium), in lax, weak, and for the most part dyspeptic persons.

2. Obstipatio (rigidorum), in people whose fibres are rigid, and frequently of an hypochondriac disposition.

3. Obstipatio (obstructorum), with symptoms of the colica 1st, 2d, 4th, and 7th above-mentioned.

Genus CXXIII. Ischuria; an absolute suppression of urine. The species are,

1. Ischuria (renalis), coming after a disease of the kidneys, with pain, or troublesome sense of weight in the region of the kidneys, and without any swelling of the hypogastrium, or desire of making water.

2. Ischuria (ureterica), coming after a disease of the kidneys, with a sense of pain or uneasiness in some part of the ureter, and without any tumor of the hypogastrium, or desire of making water.

3. Ischuria (vesicalis), with a swelling of the hypogastrium, pain at the neck of the bladder, and a frequent stimulus to make water.

4. Ischuria (urethralis), with a swelling of the hypogastrium, frequent stimulus to make water, and pain in some part of the urethra.

All these species are subdivided into many varieties, according to their different causes.

Genus CXXIV. Dysuria; a painful and somehow impeded emission of urine. The species are,

1. Dysuria (ardens), with heat of urine, without any manifest disorder of the bladder.

2. Dysuria (spasmodica), from a spasm communicated from the other parts to the bladder.

3. Dysuria (compressionis), from the neighbouring parts pressing upon the bladder.

4. Dysuria (phlogistica), from an inflammation of the neighbouring parts.

5. Dysuria (irritata), with signs of a stone in the bladder.

6. Dysuria (mucosa), with a copious excretion of mucus.

Genus CXXV. Dyspermatismus; a slow, impeded, and insufficient emission of semen in the venereal act. The species are,

1. Dyspermatismus (urethralis), from diseases of the urethra.

2. Dyspermatismus (nodosus), from knots on the corpora cavernosa penis.

3. Dyspermatismus (præputialis), from too narrow an orifice of the prepuce.

4. Dyspermatismus (mucosus), from mucus infarcting the urethra.

5. Dyspermatismus (hypertonicus), from too strong an erection of the penis.

6. Dyspermatismus (epilepticus), from a spasmodic epilepsy happening during the time of coition.

7. Dyspermatismus (apractodes), from an imbecility of the parts of generation.

8. Dyspermatismus (refluus), in which there is no emission of semen, because it returns from the urethra into the bladder.

Genus CXXVI. Amenorrhœa. The menses either flowing more sparingly than usual, or not at all, at their usual time, without pregnancy. The species are,

1. Amenorrhœa (emansionis), in those arrived at puberty, in whom, after the usual time, the menses have not yet made their appearance, and many different morbid affections have taken place.

2. Amenorrhœa (suppressionis), in adults, in whom the menses which had already begun to flow are suppressed.

3. Amenorrhœa (difficilis), in which the menses flow sparingly, and with difficulty.

Order VI. Tumores; an increased magnitude of any part without phlogosis.

Genus CXXVII. Aneurisma; a soft tumor, with pulsation, above an artery.

Genus CXXVIII. Varix; a soft tumor, without pulsation, above a vein.

Genus CXXIX. Ecchymoma; a diffused, little eminent, and livid tumor.

Genus CXXX. Schirrus; a hard tumor of some part, generally of a gland, without pain, and difficultly brought to suppuration.

Genus CXXXI. Cancer; a painful tumor of a schirrous nature, and degenerating into an ill-conditioned ulcer.

Genus CXXXII. Bubo; a suppurating tumor of a conglobate gland.

Genus CXXXIII. Sarcoma; a soft swelling, without pain.

Genus CXXXIV. Verruca; a harder scabrous swelling.

Genus CXXXV. Clavus; a hard, lamellated thickness of the skin.

Genus CXXXVI. Lupia; a moveable, soft tumor below the skin, without pain.

Genus CXXXVII Ganglion; a hard moveable swelling, adhering to a tendon.

Genus CXXXVIII. Hydatis; a cuticular vesicle filled with aqueous humor.

Genus CXXXIX. Hydarthrus; a most painful swelling of the joints, chiefly of the knee, at first scarcely elevated, of the same color with the skin, diminishing the mobility.

Genus CXL. Exostosis; a hard tumor adhering to a bone.

Order VII. Ectopiæ; tumors occasioned by the removal of some part out of its proper situation.

Genus CXLI. Hernia; an ectopia of a soft part as yet covered with skin and integuments.

Genus CXLII. Prolapsus; a bare ectopia of some soft part.

Genus CXLIII. Luxatio; the removal of a bone from its place in the joints.

Order VIII. Dialyses. A solution of continuity; manifest to the sight or touch.

Genus CXLIV. Vulnus; a recent and bloody solution of the unity of some soft part by the motion of some hard body.

Genus CXLV. Ulcus. A purulent or ichorous solution of a soft part.

Genus CXLVI. Herpes; a great number of phlyctenæ or small ulcers, gathering in clusters, creeping, and obstinate.

Genus CXLVII. Tinea; small ulcers among the roots of the hair of the head, pouring out a fluid which changes to a white friable scurf.

Genus CXLVIII. Psora. Itchy pustules and little ulcers of an infectious nature, chiefly infecting the hands.

Genus CXLIX. Fractura; bones broken into large fragments.

Genus CL. Caries; an ulceration of a bone.

PART III.

THEORY OF MEDICINE.

Having thus laid before the reader the scheme of arrangement which, for the reasons above named, we adopt for our guide on the present occasion, we shall now proceed to a slight disquisition on the theoretical part of medicine, prior to engaging in the consideration of morbid affections, separately and particularly. It is usual for authors on medicine to engage in topics of physiological bearing when treating on theory—indeed physiology constitutes a great part of medical theory—and we take the opportunity of saying that Dr. Mason Good has much enriched his volumes, published under the title of The Study of Medicine, in preliminary chapters to his pathological and therapeutic disquisitions, with a most interesting sketch of the physiology of all the functions.

In the present case, however, we shall not include physiology, as that science will fall to be treated of in a separate article, but shall limit ourselves to pathological principles; and, in so doing, we propose to avail ourselves of the proem prefixed by Dr. Uwins to his Compendium of Theoretical and Practical Medicine, this author having given a running commentary, which we are about to follow, on the classes and orders of Cullen's Nosology. Dr. U. has likewise engaged in physiological considerations; but, for the reasons just stated, we shall at present pass over these points.

265. In the first class of Cullen's arrangement, which the reader will recollect is entitled Pyrexiæ, are comprehended the five following orders—fevers, inflammations, eruptive disorders of an acute kind, hæmorrhages, and fluxes; and, as we slightly go over the pathology of the circulating organs, or, in other words, the theory of their derangement, each of the above kinds of morbid being will fall under our notice.

266. Pyrexia implies an increase of the body's heat, and it behoves us to enquire in what way this is brought about; but the enquiry is attended with many difficulties, inasmuch as the mode in which the natural heat of the frame is maintained is still a matter of some obscurity. 'When the chemical changes that take place during respiration had been enquired into, and when it was found that the capacity of carbonic acid for heat was less than that of oxygen, it was supposed that the conversion of oxygen into carbonic acid gas was the cause of the rise of temperature; and, as the heat of the lungs does not exceed that of other parts, it was asserted that the air was absorbed by the blood, and that the production of carbonic acid, and consequent evolution of heat, took place gradually during the circulation.' To these opinions many strong objections have, from time to time, been urged by different physiologists, but their complete subversion followed the researches of Mr. Brodie (Phil. Trans. 1812), who found that the heart was capable of retaining its functions for some hours, and of carrying on circulation in a decapitated animal, and consequently independent of the influence of the brain, when respiration was artificially carried on. Under these circumstances it was observed, that, although the change of blood from the venous to the arterial state was perfect, no heat was generated, and that the animal cooled regularly and gradually down to the atmospheric standard. In more than one instance the expired air was examined, and found to contain as much carbonic acid as was produced by the healthy animal; so that here circulation went on, there was the change of oxygen into carbonic acid, and the alteration of color in the blood, and yet no heat whatever appeared to be generated.

267. Since then, even on the subject of vital temperature, without reference to disease, much remains to be explained, and some positions have been assumed which experiment proves to be untenable, it follows, that to account for the increase of heat as health recedes must be a task of much difficulty; and perhaps very little more at present is known on this point than that an increase of exterior and internal heat accompanies the excitation of certain superficial or interior movements. Indeed, heat from motion, and cold from quiescence, are, with some modification, laws of inorganic matter; so much so, that some philosophers have considered the introduction of a subtile material, as the essence of heat, to be not only gratuitous but unnecessary, and have maintained that heat, like every other incident of bodies, is but a manifestation of altered form or circumstance of the body; and, although inorganic and organised being are regulated by different laws, we see and know enough of the latter to be convinced that action and heat are in some measure connected even in it, in the way of cause and effect. But let us, dismissing the intricate topic of natural and morbid heat, as excited and maintained in an organised body, say a few words in succession on the several disordered conditions above enumerated, viz. fever, inflammation, eruptive affection, hæmorrhage, and flux. The order, however, of the two first, for reasons which will soon be obvious, we shall reverse, and treat, in the first place, on inflammation.

268. When treating on the circulation, in the article PHYSIOLOGY, we shall have to state that one of the arguments adduced in favor of an independent power in the arterial system—that is of a power independent of the motive power of the heart—is taken from the circumstance that partial distribution of blood may have place without, in the first instance at least, the heart itself being changed from its steady course of regular procedure. Thus, in a given spot, an increased quantum and momentum of blood shall be discoverable; this augmented momentum and excitement shall bring with them an increase of heat, and eventually all the phenomena shall manifest themselves to which the term inflammation would be applied, merely from topical or local causes, the heart and other parts of the vascular organisation only then coming to be affected when the commotion shall have excited what are called sympathetic or secondary considerations. But inordinate action, and consequent heat, do not of themselves constitute inflammation. Of what then is inflammation actually formed? We may suppose the eye to be suddenly and unexpectedly subjected to an undue quantity of light; inordinate excitation is the immediate consequence, in other words the fibres of which the organ is composed are for a time irritated into more vigorous movement than is ordinarily the case; the volume and force of its circulation are rendered more abundant, and visual perception is in the same ratio increased. All this however may exist without the presence of positive inflammation; we have here augmented, but not otherwise deranged action—the error loci of the schools has not taken place; the component parts of the blood preserve their proportionate relations, and the ordinary standard of circulating power is shortly restored without the intervention of organic derangement.

269. But let the stimulus be applied with more force, or let it be brought to act under greater than usual irritability of the organ, a different state of things will soon commence; the blood vessels, which are usually colorless, will now be seen to convey red blood, new secretions will take place, and in the course of a short time new parts or vessels will be actually formed. If, then, we are asked for a definition of the inflamed state, as opposed to mere excitation or fulness of vessel, we reply that it is such excitation or such plenitude carried up to the extent of actual derangement; the capillaries do not merely momentarily receive, but positively and permanently circulate an unhealthy quantity of blood; while this break-in upon her orderly course nature will not permit, without setting about the work of regeneration in order to be ready, as it were, for the breach that is about to be made.

270. Actual inflammation, then, seems to a certain extent to be disorganisation, and this disorganisation implies a weakened state of the capillary or smaller vessels, either forcibly, induced by the rush of blood into them when the inflammation has been more active, or sthenic,

as some pathologists would call it, or more passively brought about when the impetus has not been much above its common grade, but when from some circumstances of obstraction, or other accidental conditions, the capillaries are made to receive and transmit such a quantity of blood as to distend them and excite them into perturbed motions; for in either case undue action and irritation seem necessary to the formation of the inflammatory state, otherwise the state would be that of mere fulness or congestion.

271. Why in case either of more active or passive inflammation, says the author whom we are now following, there should be the resisting and repairing actions set up which have been above adverted to, there is no possibility of explaining beyond an appeal to final cause, and this Deus intersit language ought never to be introduced when the subject is not morals nor religion but physiology and physics. What, it has been justly remarked, does John Hunter's 'stimulus of necessity' amount to, as applied to the blood's coagulation, more than that the blood coagulates because it must coagulate?

272. 'If there be any correctness', he continues,' 'in what has been above advanced in reference to the essentials of inflammation, it would seem, moreover, to follow, that the dispute is somewhat idle and unmeaning, whether inflammation be weakness or strength, action or torpor, obstruction or other impediment; it is all and every thing as the general frame and local incidents shall vary; and both as to pathological essence and practical indications abstract views ought to be kept as much as possible from influencing judgment.

273. In reference to the modes in which inflammation terminates, it may be said, that the term resolution is generally meant to express that recovery from the morbid state which is effected without the intervention of any disorganising process. But this event, strictly speaking, is not perhaps possible, since the existence of the derangement supposes, as above intimated, some degree of disorganisation. Even the most simple case then of resolution seems to imply some degree of absorption, and it is probable that the remedial agents that are had recourse to, under the notion of subduing vascular action, effect their purpose in part by giving an impulse to the absorbing faculty. The readiness with which adhesion takes places under inflammation, between membranes that are in apposition, is a proof of the rapidity with which inflamed vessels pour out lymph; and this lymph, if not again taken up into the circulating mass, often becomes organised in a very few hours; a process this which is one of the most remarkable in the whole circle of animal movements, and which, on account of its important bearing upon pathology generally, we shall illustrate by the recital of a case in proof. A man was operated on for strangulated hernia at seven o'clock in the morning. The hernial sac was laid open, and the gut, which proved to be a portion of the ileum about six inches in length, was attentively examined previously to its being returned into the cavity of the belly. It had the natural polished surface peculiar to intestine, and although its vessels were tinged with blood it did not appear that they were uncommonly numerous. After the operation the symptoms did not abate so much as might have been expected, and during the afternoon a pain was complained of in the lower part of the belly. There was no passage by stool, and next morning, about seven o'clock, the pulse was scarcely perceptible; the skin was cold and clammy, and at about twelve o'clock at noon the patient died; having lived twenty-nine hours after the operation.

274. The body was opened, and the portion of gut which had been strangulated was found considerably inflamed, the external surface having lost its natural polish, and having several small portions of exudated coagulable lymph adhering to it. The vessels of the gut were minutely injected; the arteries with a red colored injection, the veins with a yellow one. Upon examination afterwards all these adhering portions of coagulating lymph were found to be injected, having a considerable artery going to each of them, and a returning vein which was larger than the artery. It is evident, therefore, that the coagulating lymph was laid upon the surface of the gut after the operation; and we cannot suppose, says the narrator, that any such process as forming new vessels could have been going on during the last five hours of life, when the pulse at the wrist was scarcely to be felt, and the powers of life were so much weakened in every respect. We must therefore conclude that the whole operation of throwing out coagulable lymph, and supplying it with blood vessels after it had become solid, was effected in less than twenty-four hours!

275. If inflammation be not resolved, or it may not have terminated by effusion, or this new and adhesive action, suppuration, or the formation of pus, is the next step in the process. On the manner in which pus is formed, opinion was exceedingly vague to the time of Dr. Morgan and the justly celebrated Mr. John Hunter. Even Pott, in his estimable works, alludes to the formation of pus as if it were some how or other the consequence of the solid parts being melted down; and in the first lines of Dr. Cullen this same theory is broached. The general sentiment among pathologists of the present day is, that pus is a peculiar secretion from vessels in a certain condition, but what the precise state is which originates pus seems still an unsettled matter. Pus, indeed, is evidently engendered under different circumstances of the vessels, and, although it is usually the result of inflammation, it sometimes seems to be the consequence of an irritative action which is under the grade of positive inflammation; as when it is secreted from mucous surfaces after a long continuance of chronic, but not perhaps truly of inflammatory ailment.

276. Gangrene is in fact the death of the part which the disorder implicates; the rush of the disease has proved too violent for the organs to bear; the living reaction has failed of accomplishing its purpose 'and the laws of animal chemistry, thus far held in subjection by the superior sway of the living power, acquire an ascendancy; a play of chemical affinities takes place, and putrefaction or a decomposition of the organised

substance, and a restoration of its constituent parts to their elementary forms, necessarily ensues.

277. We shall not proceed further in the consideration of the inflammatory state, as the subject, in a more enlarged and detailed manner, will fall more properly to be noticed under the head of SURGERY; and it is now in order that we pass on to the topic of fever generally. This word fever, in its extended application, constitutes, says Dr. Uwins, a curious example of the principles upon which nomenclature is founded in medical science. Observers of morbid phenomena could not have been long in ascertaining that in some deviations from health the heat of the body is preternaturally increased; and, connecting this leading and characteristic effect with a vague idea of causation, they thus made a single symptom in a manner expressive of a whole cause. But as animal heat, or the temperature of the body, is equally augmented under very different circumstances of the frame, it became necessary to seek for epithets further expressive of these varieties; and hence the adjectives nervous, bilious, inflammatory, putrid, were attached to the generic term fever.

278. Now that local condition of vessels to which we have above adverted, under the term inflammation, never takes place to any great extent, or lasts for any length of time, without giving rise to those irritative actions throughout the whole frame, by which, or in conjunction with which (to avoid language expressive of cause), the heat of the whole body is increased. In this case a sympathetic or symptomatic fever is said to have taken place. But it is not always that fever, or an increase of heat, is traceable to these local circumstances; and, when it is not so traceable, the disease has been named in the schools idiopathic, as contradistinguished from sequential or symptomatic fever.

279. We know not the reason, even when there is local inflammation, why such topical disturbance should produce systematic derangement; but when the general derangement occurs without such commencing point, or starting post, we seem to be placed in still more difficulty on the score of pathological explication. This last difficulty, indeed, some pathologists have endeavoured to prove dispensable; they maintain that fever is in reality *always* a symptomatic expression of partial disturbance, although the local derangement shall not in all cases be the actual subject of perception. But there is a difference of opinion among these theorists, as to the first link in the chain of morbid process. Some maintaining that it is the brain, others that it is in the membrane which lines the alimentary and intestinal canal, and some considering that the chylopoietic or assisting chylopoietic viscera are the parts upon which that morbid irritation first falls, which comes thus to extend itself through the frame generally, and each appeals to post mortem appearances in support of his particular theory; that is, the speculatist who asserts that fever is inflammation of the brain, virtually from first to last, calls your attention in the first place to the derangement of the animal functions by which fever is constituted, and which, as he asserts, implies brain affection; and in the next place he tells you, that you will generally find, upon inspecting the head of an individual that has died of fever, the presence of marks which indicate that an inflammatory process of disorganisation has been proceeding in this part during the existence of the malady; that this disorder of the animal and intellectual functions is very characteristic of fever, and in a degree almost essential to its existence; and that vestiges of inflamed brain are frequently seen; while others, admitting these facts, refuse their assent to the position that fever is inflammation of the brain, and inflammation of the brain fever, alleging, that a great degree of disturbance in cerebral functions may exist without the necessity of inflammatory action, and that the post mortem showings are rather consequential and incidental than primary and of necessity. It is well known, they further say, that inflammatory and other disorganising processes occasionally take place in the bowels and viscera under the presence of fever, and that the disorder in question has therefore as much title to be considered inflammation of these parts, as of the brain itself. Some, indeed, do consider that the essence of febrile action consists in an inflamed or irritated state of mucous surfaces, while others argue, that the malady consists mainly in general perturbation, and that inflammation, although of common occurrence, during its progress, is not essential to its existence.

280. A febrile paroxysm consists, more or less distinctly marked, of rigor, then of heat, and, lastly, of perspiration; but, in tracing the rationale of these several steps, we find ourselves involved in much that is obscure and perplexing; and that partly in consequence of the ignorance to which we have before adverted, in regard to the laws by which both actual heat and the sensation of heat are instituted and exercised in animal existence. The disturbance, however, of the corporeal movements by which the first link of fever is constituted, whatever be its actual and precise nature, seems a something, which in one moment, in uno ictu, as Fordyce expresses it, runs through the whole fibres, and texture, and functions of the sentient organisation; it is a shock to which succeeds the rigor, which rigor, though expressed in English shivering, is not exactly the same sensation as cold, although it is more like it than any other sensation; and to account for the sudden generation of cold would be, in some measure, to account for the feeling in question. There is in the shock and rigor of fever, a sudden induction as it were of quiescence, a temporary suspension of the ordinary movements; and hence, in part at least, seems to arise the perception. It is a curious particular, as remarked by Dr. Fordyce, that the power of diminishing heat, without such heat being given out to surrounding media, is common to the first stage, or preliminary quiescence, of fever. The body seems in a manner to lock up its own heat; or, perhaps more properly speaking, by ceasing for a time its action, ceases in the same ratio to engender or manufacture heat. We probably then are permitted to go thus far in the explanation, viz. that an abrupt suspension of vital forces occasions the generation of cold, and

causes a shrinking and contraction of the extreme vessels, and that, after this suspension and contraction existing for some time, excitability is as it were accumulated; so that, when the system recovers from it, the ordinary reacting movements or external impulses cause undue impetus, and hence the commotion constituting the irritative portion of the series of actions by which consecutively fever is made up. This is, in fact, the mode in which the disciples of Stahl and of Cullen would explain the phenomena of fever; only that in the schools of these celebrated teachers, especially in that of the former, a sort of intelligence was supposed to be connected with these reacting impulses, to the directions of which it behoved the pathologist and practitioner to listen. Thus, to that primary shrinking the term spasm was applied by Cullen, with some looseness perhaps of phraseology, and a phraseology to which many objections have been advanced; but it does not appear that the successors of Cullen, who have loudly called out on the absurdity of his terminology and doctrines, have substituted others much more precise or satisfactory; and from the whole it would appear that the perturbation of fever may be present without the actual presence of inflammation, but that it seldom lasts long without being productive of the inflamed state, as it is natural to expect would be the case when circulating impulse is exercised with such irregularity; the nervous power directing the arterial action in such sort as to cause the facile production of topical inflammation and all its consequences.

281. When fever, instead of suddenly rushing as it were upon the subject it attacks, occurs more slowly and insidiously, as in the instance of its proving consequent upon mental uneasiness, then, we believe that the brain for the most part partakes essentially, if it may be so said, of the disorder's essence, and that the disorder of the whole system is the result of an inflamed state of brain.

282. But how, it may be asked, is the increased heat under fever explained? and what is the pathology of the perspiration which succeeds?

In the hot stage of fever, says the author whom we are now following, it has always appeared to me that phenomena present themselves inconsistent with the chemical theory of animal temperature, even had we not been furnished with the refuting experiments of Mr. Brodie, before alluded to. During the heat of fever there is often much less change effected in the pulmonary organs, than while the body is free from disorder. Nay, the breathing an oxygenous and vivifying atmosphere will often serve to cool, while azotic or carbonaceous air will heat the body; this is so conspicuously the case, that some have proposed, as, in part at least, an explanation of fever's essence, the circumstance of carbonaceous rather than vivifying blood circulating through the brain, and producing the sensorial and other disturbance. Be this as it may, we certainly are compelled to ascribe the morbid heat, under the affections supposed, to a derangement in the sentient faculty, and to the commotion which the disorder induces, rather than to any decomposition of the air which the individual respires. In this announcement, however, we rather cut through than untie the knot, and both the primary cold and subsequent heat of a febrile paroxysm are in respect to their rationale still involved in some obscurity, and connected in some hitherto unexplained way with vital peculiarities.

283. Perspiration is the final stage of a fever fit; and it becomes a question how this is brought about? and upon what principle it is that synchronously with the production of sweat, the body's temperature is reduced. At the time when the pulmonary theory of animal heat was generally admitted, it was ingeniously conjectured whether perspiration is not in all instances the converse of respiration in regard to its agency in the system; or that, as the lungs are the inlets of the calorific principle, so is the surface of the medium through which the heat is prevented from rising too high. 'That an animal,' says Dr. Currie, 'possesses to a certain extent the faculty of rendering sensible heat latent, or to speak more philosophically of reducing caloric from a free to a combined state, in cases in which the stimulus of heat might otherwise overpower the living energy, there is reason to believe from a variety of experiments and observations; and that this in part is performed by perspiration from the surface, can scarcely admit of a doubt. The process of perspiration, which is continually going on from the surface of the body, is in this point of view the converse of respiration. As in respiration a gas is constantly converted into a solid or fluid, and thus heat is evolved, so in perspiration a fluid is constantly converted into a vapor, and thus heat is absorbed. A vessel filled with water, and exposed to the atmosphere, cannot be raised above 212° of Fahrenheit by any quantity of fuel, because, as heat is supplied from below, evaporation carries it off from the surface; in like manner we may suppose the heat of the human body to be kept uniform by the evaporation from the surface increasing or diminishing, according to the quantity of heat extricated from the system, or received from the surrounding media.'

284. To a certain extent this doctrine, of perspiration being a regulator of heat, may be admitted. But it ought to be recollected that we have agents that are capable of reducing the heat of the body, without producing sweat; and Dr. Currie himself admits that, from some experiments in the hot bath, it appears that the temperature of the body is with difficulty increased after the sweat begins to flow, although there is, of course, no evaporation from the surface while the body is immersed in hot water. Our theorist meets the objection, which starts up from this source, by supposing that perspiration is a cooling process even in its being engendered internally, and before it breaks out upon the surface, from the fact of this fluid having a greater capacity for heat than the blood, and thus absorbing or reducing temperature in the moment of its formation.

285. But it has been said that the matter of sweat is actually secreted in as great abundance during the heat of fever as after the paroxysm

has declined; and we know also that many agents prove cooling without proving sudorific; and, upon the whole, we must conclude that, as in the instance of natural and morbid heat, so in the case of its modification and reduction, there is still much that does not admit of explanation by the assumptions and inferences of chemistry; and that vital actions and sentient impulses must be taken into account before we can take one secure step in the way of tracing the rationale of function.

286. Why, it is natural to enquire, does not sweat immediately result upon the reaction and heat of fever? Why does the surface for a time pertinaciously retain its dryness and heat, and then all at once give way and become bathed in perspiration? For suppose we allow the correctness of the statement made above, that sweat is produced as freely during heat as after the declension of heat, even then we must admit that the vessels on the surface are in a different condition, under the actual appearance of sweat, from that of dry heat. Dr. Cullen and his disciples would reply to this query, that the rush of blood and newly excited action eventually succeed in dissolving the spasm of the small vessels, and thence the resulting phenomena; but, besides that this is saying it takes place because it does take place, we must suppose the subsidence of the spasm, or the giving way of contraction in the extreme vessels, prior to the full establishment of reaction. Dr. Park has endeavoured to refer these circumstances to a similar law with that which takes place in some of the hollow muscles, as of the bladder and rectum, in which the sphincters or outlets always act in opposition as it were to the organ itself; when one is in a state of contraction, the other is in that of relaxation, and vice versâ. In consistency with this principle, he says, that the exhalants may be received or furnished at their extreme points with a species of sphincter agency; and that, when the vessels on the surface give way before an inordinate rush of blood, the extremities contract to retain it, and that this contraction only ceases when the retaining power of the vessel is stretched to a certain pitch; as we micturate of necessity when the urinary bladder is full. Is not this hypothesis open to the following objection, even if otherwise tenable? that it supposes the capillaries to be organs of mere retention and transmission, not, as they in reality are, actual secretory vessels. Were it the mere rush of blood that the shut mouths of the extreme vessels retain, the discharge when constriction is overcome ought to be blood, or at least the thinner part of that fluid, and not, as it proves, a new secretion.

287. With respect to the exciting causes of fever, opinion is still as various as in reference to the rationale, or proximate cause, as some express it, of the febrile state. This question of the excitants of fever in part involves another, viz. what are the kinds and species of fever? Some assert that fever, whatever type or external character it may display, is always one and the same thing, and that there is no difference except in the imagination of the nosologist, between the malignant plague of the Levant, and the low, or as some call it the typhoid, fever of a London alley. Others again divide and subdivide to an enormous amount, under the feeling that every new modification of the ailment, in acknowledging a distinct source, demands a distinct appellation. While some steer a middle course, and imagine that fevers, though in one sense they are identical, are susceptible, in point of fact, of greater divisions than the identifiers of disease acknowledge. Genuine fever, say one class of pathologists, never can originate without the agency of contagion; others, on the contrary, go so far as to deny the contagious quality of any fever except in the instance of certain specific disorders as the small pox; while a third party are ready to admit that contagion is an agent in the production of fevers, but at the same time contend that the disorder may be elicited from other powers, such as the undue influence of temperature, famine, repletion, filth, confined air, and even mental agitation.

288. The words contagion and infection have sometimes been used synonimously, and this has occasioned some want of precision in the reasoning, and uncertainty in the inferences, of speculatists. Contagion, says the writer whom we are now principally following, is, by the general acceptation of the term, a something which, coming in contact either immediately or intermediately with the body of an individual previously in health, engenders a disease in that individual of a nature precisely similar to its own; it implies, in a word, specific poison. What is infection, as opposed to contagion?—If we take a journey to Constantinople while the plague is raging in that city, and if by consequence of our residence there we fall sick of the plague without having come into contact with the matter that shall have emanated from the body of another person who is the subject of plague, we receive an infectious malady. Here then is stated to be the difference between an infection and a contagion; that the one is atmospherical, or only through the medium of the unhealthy air communicated, while the other implies communication, either direct or indirect, with a something issuing from the body of the sick. In either case, indeed, the contact with a poison is, strictly speaking, supposed; and hence there is some impropriety in basing the notion of difference upon the assumption of different operation. 'I am disposed to think,' says our author, 'that much of the intricacy that attaches itself to the question of contagion and infection originates in this very source; that is, a variety in modus operandi is presumed which is really non-existent. Let us imagine that a patient dies in the Levant of the disease called plague, and that the clothes in which he died are conveyed to this country imbued with the poison of plague. An inhabitant of our metropolis procuring and putting on these clothes might be affected with a certain dose, so to say, of disease; but still, though the virus may be as active in se as had the same appropriation of the habiliments been made at another quarter of the globe, yet the resulting distemper might nevertheless be various; and in that case you would say of the individual that he had taken an infectious as well

as contagious distemper. In this way then the question may be viewed as standing out in a tangible form. Is there any reason to believe that some disorders are entirely of an abstract nature, dependent solely upon their several exciting sources, without reference to time, place, or circumstance? Or does the modifying power of place always, to some extent, operate upon the nature and aspect of a distemper?' 'For my own part,' continues the writer we are quoting, 'I am disposed to think it does, so that though in some cases I incline towards the sentiments of the anti-contagionist, I in another recede from his inferences, even much further than does the contagionist himself; for I believe that, from the most decided case of small pox, down to a nursery cold, there is something communicable in the maladies, and something operative in the atmosphere.'

289. The author goes on to other illustrations, which we have not space to quote, of the same principle—that is, he endeavours further to demonstrate, that even those distempers which seem, so to say, the most abstractedly dependent upon their own peculiar sources, are in some measure modified by atmospheric influences, and that thus specific contagion falls by insensible degrees into malignant, and that again into mild or general disorder, as the succession of time or the variation of circumstance directs. Having, however, admitted that on these points there is much to learn, much to unlearn, and much probably that will be for ever hidden, he concludes the section of his book which refers to the excitants of fever, by the following announcement of facts and opinions:—

290. There is in all fevers a tendency to periodical accession and decline, but in some cases this is so complete and so marked that the patient is left during the intervals in total exemption from the disorder; hence the term intermittent. In other instances, though the malady gives way in part, it does not wholly. Now, the intermittent shapes of fever have been observed much more frequently in marshy situations, or where shallow stagnant waters abound; and they have on this account been usually attributed to a poisonous exhalation of miasm arising from the decomposed materials of a soil thus circumstanced. Others have argued that there is no necessity of interposing the notion even here of a specific poison, since the coldness and dampness of the country are quite sufficient to account for the effect. When, however, we find that in some situations not marshy, but otherwise unhealthy, intermittents do not, or but seldom appear; when we see that the draining of lands from shallow stagnant waters has considerably lessened the frequency of these fevers; and when we recollect that the neighbourhood of deep waters, though equally cold, is not so insalubrious as that of a marshy vicinity, it appears to be carrying a disposition to generalise too far to question the specific agency of marsh miasmata. But the influence of this may be much modified by other agents; and, in cases where we have very high variations and sudden vicissitudes of temperature from the sultry day to the damp foggy night, and where at the same time the land is low and marshy, there we meet with modifications of yellow and intermittent fever under the shapes and denominations of bilious remittent. Again, let these circumstances of soil and temperature operate in conjunction with animal decomposition, and the resulting disorder assumes more of what has been called a putrid type, still retaining some of the features either of remission, intermission, or yellow hue, that have been imparted to it by its other excitants besides that of the main and master one. Whether, then, we shall name all these fevers differently as they thus assume various shades and modifications, becomes in some measure a dispute about words, only that it is important to recollect that these varieties are rather local, endemic, and incidental, than inherent, abstract, and essential.

291. The remaining orders in Cullen's first class or pyrexia are exanthemata, hœmorrhagia, and profluvia. Exanthamata is a term applied to diseases which break out on the surface of the body in the form of rashes or otherwise. The theory of these diseases is often very difficult and intricate. The ancients, who were for the most part contented with generalising inferences of not a very precise nature, supposed a sort of internal commotion of humors, which, after battling about for some time, settled on the surface, something after the manner of fermenting materials, which eventually come to subside into their respective localities; indeed the humoral pathology, as it has been termed, of more modern times, reasoned in some measure after this sort; and averse as we may be from falling into these notions, now that the laws of secretion and excretion are more scientifically traced, we must still, nevertheless, admit that there is in the phenomenon which some of the rashes exhibit not a little that justifies the crude analogies alluded to.

292. It is right to remark here that Dr. Cullen confines his views of the exanthemata to those affections of the skin which are not only attended with, but which are actually ushered in by, fever; and it is through the means of this fever that the disorder is thought to work its own cure; for it is hereby that a general determination is made to the surface, and the morbid poison is thrown off from the system.

293. 'When a febrile poison producing a cutaneous eruption is generated, or has been conveyed into the blood, a small degree of fever is sufficient to throw it upon the skin; and, if it exceed the proper extent, the specific virus will be multiplied, and the fever itself may become a source of real danger. It was formerly the practice to encourage the fever by cardiacs, a heated atmosphere, and a load of bed clothes, from an idea that we hereby solicit a larger flow of morbific matter from the interior to the surface. The fact is unquestionable; for, be the exanthema what it may, the skin will hence in almost every instance be covered with eruption. But it did not occur to the pathologists of those times that the morbid virus was an animal ferment, capable of multiplying itself by accessories; and that heat and febrile action, beyond a very low medium, are among the most powerful accessories we can communicate. And hence

the advantage of applying cold water in scarlet fevers, and cold air in small pox, with a view of mitigating the fever that often accompanies these diseases; for, by diminishing the febrile violence, we do not as was formerly imagined lock up the contagion in the interior of the system, but prevent it from forming afresh and augmenting there.'

294. To this law, however, of moderating rather than abetting excitement, some limits must be made in theory and practice; and here it is of importance to remark, that of late years a connexion has been traced between the action of the outer skin, and internal membraneous surfaces, and that in especial reference to febrile disorders that are expressed by rashes. The connexion seems to be of that nature which is denominated by Darwin reverse sympathy, which had long ago been recognised in the case of catarrhal irritation, but which has recently been more particularly traced and applied to the affection now under notice. Suppose the whole surface of the body to be covered with a thick crop of eruptions, if you too precipitately arrest the morbid processes which these eruptions imply, you thereby cause the surfaces which line the interior, both of the alimentary and aërial passages, to take on an action, at least somewhat similar if not precisely the same, as that which you have interfered with on the exterior. In some instances this vicarious sort of connexion is more marked than in others; but in all cases of skin activity it is in a greater or less measure conspicuous. In all it requires to be attended to in practice, and, indeed, in modern medicine is attended to, much to the credit of the science, and to the benefit of the patient. It may be right just to remark here that the connexion appears to have some relation, at least, to kind as well as degree; for in the eruption of scarlet fever, and especially measles, though the cutaneous disturbance may not be nearly so great as in the instance of small pox, the internal tendency, upon either natural or artificial repression, appears greater. It will be found necessary in practice to proceed under a recollection of this fact, and to be wary of bringing down the irritation on the surface with too much freedom, where the internal tendency to the vicarious irritation now referred to is thus conspicuous.

295. The next order is hæmorrhages, in which there is some degree of analogy with inflammations; that is an inordinate impulse given to the blood may produce the discharge in a direct way, as in the case of active inflammation; or the discharge may be brought about by want of resisting or retaining power in the vessels themselves, the impulse not being much more than ordinary. It is proper, however, to take into account, when we are considering the pathology of hæmorrhages, that a discharge of blood does not necessarily imply an actual rupture of vessels, since the impetus may be so great as to force blood through the terminal capillaries, or those small vessels which terminate by open mouths upon surfaces, and thus may a very considerable profusion be produced, while the coats of the vessels remain unbroken. In this case inflammation and hæmorrhages are exceedingly analogous: but, in the case of discharge of blood, the discharge in some degree operates its own remedy, that is, as far as the inflammatory process is concerned, although a new disorder is sometimes engendered by extravasation into parts which, having no outlet, are incapable of immediately ejecting this foreign matter.

296. Hæmorrhages were formerly conceived to have great dependence upon external circumstance, that is, to be influenced by variations in temperature and aërial density; heat expanding the circulating blood beyond its ordinary tenacity, and the varied states of rarefaction in the air causing a varied condition in the rarefaction or condensation of the fluid while flowing in its vessels; and, although the laws of physics and chemistry are ever held in subordination and check by the commanding energies of vital forces, it is perhaps questionable whether the pathology of the present day is not too regardless of external agents in the rationale of internal processes. Hæmorrhage from the nose and from the lungs is not seldom induced by breathing an air more than commonly rarefied; and without going to the full length of Hoffman, when he talks of orgasm, ebullition, and turgescence of blood destroying the systaltic and elastic power of the vessel, and thereby inducing congestion, distension, and rupture, we may at least subscribe to the doctrine of some immediate change in the blood's condition, as caused by external agents, beyond the influence of these agents as mere vital excitants.

297. Persons ascending elevated regions, when the atmosphere is less dense or more rarefied than that immediately surrounding us, have been seized with hæmorrhagic attacks, which could not be ascribed solely to exertion, but must be in part referred to atmospheric change: a proof this that even in circulating blood some direct alteration may be effected on its volume by the varied circumstances of external exposure; even here, however, we are to take into account the probable influence of the supposed change upon the living fibre as well as upon the circulating fluids; and upon the whole it seems right to recognise, as above intimated, the superior power of vital causation, while we admit, in a qualified and subordinate way, physical and chemical agency.

298. When hæmorrhage takes place from obviously exciting causes, such as a flow of blood from the nose in consequence of a blow, or when spitting of blood is induced by violent exercise of the lungs, it does not seem very difficult to follow the steps of the morbid process; but the occurrence of spontaneous hæmorrhage, as of spontaneous inflammation, brings with it a little more of difficulty in respect of explanation; and here we must have recourse to the idea of plethora, and to an irregularity in the blood's distribution arising out of that state of the system to which the predicate of plethora is applied. On the nature and essence of plethora much controversy has arisen; and, indeed, by some the possibility is denied of more blood being at any given time in the body than the vessels can conveniently contain and carry. It

is averred that the secretory and excretory organs would take care that this should not be the case, and that the demand upon them is ever in proportion to the ingesta or matter received from without. But, were these functions always thus true to their charge, very little of disordered action would ever be manifested; and the fact is, that the very tone of the system which produces appetite, free digestion, and, in consequence, occasions more blood and chyle to be formed, is that condition which contracts the blood-vessels and the secernents at the same moment, and thus occasions a more than due quantity of blood to be contained through the whole of the circulatory organisation. We know also that, for the secernents and excretories to be kept in a due condition of activity, a certain quantity of exercise is required on the part of the individual. In default therefore of the exercise a plethoric state may be induced, since rest in some conditions of vigorous stamina may not be equal to causing a failure of appetite and ingesta. This species of plethora, if it be admitted, implies a stenich diathesis, to use the phraseology of some pathologists; and, although in itself not disease, certainly predisposes to it, by rendering the system more obnoxious to the effect of the slightest and otherwise scarcely operative irregularities.

299. But it is further conceivable that the vessels may be overladen and over distended while the actions of the system are in respect of tonicity or sthenic condition rather below than above the ordinary standard. In this case, however, the blood would be more tenuous as well as in larger quantity, and the morbid inclination would be more towards the next order of disease, the profluvia; or rather it would be towards serous effusion and dropsical accumulation, on the rationale of which a few words will be said under cachexia.

300. The schools have admitted a plethora ad molem, which implies an actual expansion of blood in the vessels; and this in some degree may have place if what has been advanced on the subject of aerial density or tenuity and their effects has any foundation in fact.

301. *Profluvia.* A certain kind and quantum of excitation in the excretory organs increases their natural discharge; but a diminution as well as increase in this excitation may also be productive of inordinate discharge. Thus coryza from the nose, and tears from the lachrymal glands, may appear in superabundance from mere exposure to cold, which being a deprivation of heat is in fact a deprivation of stimulus. There would seem at first some difficulty in reconciling these 'hot and cold blowing' phenomena, but the following explanation may be deemed sufficiently satisfactory. 'The absorbent vessels become torpid by the diminution of the external heat sooner than the secerning ones, which are longer kept warm by the circulating blood, from which they select the fluid they secrete; whereas the absorbent vessels of the nostrils drink up their fluids, viz. the thin and saline part of the mucus, after it has been cooled by the atmosphere. Hence the absorbents ceasing to act, and the secerning vessels continuing some time longer to pour out the mucus, a copious thin discharge is produced, which trickles down the nostrils in cold weather. This discharge is so acrid as to inflame the upper lip, which is owing to the neutral salts with which it abounds not being re-absorbed; so the tears in fistula lachrymalis inflame the cheek.

302. But there are circumstances connected with morbid activity in the secernent vessels which are exceptions in appearance to the more general one of increased secretion being equivalent to increased excitation. In the first case a given quantity of excitement, or that quantity applied under a given state of the secerning organisation, shall arrest secretion or flow altogether. Shall we say here that both the exhalants and absorbents are in a state of increased action, but the absorbents have obtained the mastery in the contest; or shall we suppose, with Dr. Parr, a sort of opposition between the small vessels and their sphincter extremities; or shall we confess at once that we have much of difficulty to grapple with when we trace functional relation to exterior agents? Again the flux shall be continued by habit after all extraordinary excitation is gone by. By habit! What do we mean by this term? Merely a statement of fact; and it is really not easy to say why a thick ropy secretion should be continued to be poured out from the mucous surfaces, after the cessation of that cause from which the flux had primarily proceeded. The absorbents here would seem to do something more for the poured out matter than merely drink up its watery and saline parts; for the secretion often gradually changes in kind as well as consistence; and at length, under particular conditions of the part and of the frame, slides, as we have before intimated, into purulent condition.

303. With these remarks we conclude our preliminary comment on the first class of Cullen's system, and we now proceed to observe in the same cursory and prefatory manner on the second division of the system, viz. neuroses, which comprises the four orders comata, adynamiæ, spasmi, and vesaniæ.

304. Comata. 'Diminished voluntary motion with torpor or a suspension of sense. Here, we are told, an obvious and large objection immediately rises up against classifying attempts. Let a few branches of blood be ruptured and a little blood be poured out upon the brain, by which primarily and properly a mere hæmorrhagic disorder is constituted, and you have instantaneously all the symptoms presented to you of Dr. Cullen's first and most important order of nervous ailment. Again, the two genera of this order are apoplexy and palsy; the latter of which often occurs without coma, and is, in truth, a mere adynamic affection; so that the class neuroses in its leading definition, and in both the genera of the very first order, is far from correctness either in admission or omission.

305. Coma is usually produced by pressure upon some part of the encephalic mass, and this pressure for the most part occurs from fulness of vessel, or from extravasation; but that this is not always the case may be analogically inferred from the phenomena of a drowsiness that is below the

grade of actual disease. Let an individual, for instance, feel himself almost irresistibly impelled to sleep, under the ordinary excitants by which he is surrounded; but add a larger quantity, or subject him to a different kind of excitement, and his soporose tendency immediately changes into wakefulness and vigor. Now in this case we cannot suppose that pressure on the brain was the cause of the drowsiness, or the removal of that pressure the occasion of the wakefulness; the altered circumstances and feelings must surely have reference rather to some unknown change in the sentient energy than to the mechanical condition, if we may so express it, of brain and nerve; and an inference has been adduced from these occurrences against the theory altogether, which ascribes the sopor of apoplexy to either fulness or pressure. Even in those instances of sentient abolition that are unquestionably connected with hæmorrhage upon the brain, some theorists will pertinaciously contend that the hæmorrhage is rather a consequence than a cause of the suspended functions, and that it is in the derangement of nervous energy that you are to look for a satisfactory exposition of comatose circumstance.

306. But we believe the moderate and unsystematic or independent observer will only permit the fact referred to, of volition and sense being interfered with, where no pressure can be supposed to influence his mind against the common theory of apoplexy to a certain extent. He will be led by reflection on it to qualify, not to reject, the principle. He will in some sort accord with this theorist who talks of broken down nervous power, and with that who refers the whole business rather to altered circulation than to actual pressure; but he will also recollect that the Parisian beggar could at any time bring an apoplexy upon himself, by merely pressing upon a denuded portion of the brain; and he will duly recognise the fact, that a man who was but a few short moments since in health and spirits may be now lying before him snorting under the succumbence of hæmorrahagia cerebri.

307. The fault in this, as in other parts of pathology, consists in assuming that there must be one spring and source of ailment to the exclusion of all others; and the error here has not been limited merely to theoretical speculation. It is to be feared, on the one hand, that the lancet has been systematically withheld at the expense of life; and that, on the other, large depletions have acted in aid of disordered forces to determine the patients' untimely fate. An intermediate but not a neutral course seems to be the safest plan of procedure, and a great deal must be left to the practitioner's judgment and to the particular circumstances of the individual case. But it is theory rather than practice to which we are now attending.

308. Of the adynamiæ, the second order in this second class, we may observe, the existence seems sufficiently well established. It is easy to conceive of defective power in the involuntary functions from defective nervous supply, without resorting to the condition of blood-vessels for an explanation of the circumstance. That these functions may thus be interfered with, by some unknown condition of that part of the nervous organisation under the influence of which they are exercised, all experiments and observations bearing upon the point tend to prove, and none more so than the recent ones of Dr. Wilson Philip; who not only, by dividing the nerve which supplies the digestive organs, puts a stop to the process of digestion, but who also causes digestion to be continued or resumed, by so placing the animal experimented on under the influence of voltaic electricity that this latter is made a substitute for the nervous energy.

309. Adynamic disorders, or, in other words, disorders of defective power, have often been supposed when inflammatory conditions had been really present; and to say of disease it is a defective power, without minutely investigating all its phenomena, is to let loose upon our minds a speculative principle which may be highly injurious to our patients when carried into practical application. But at the present day the tendency of theory and practice may be rather to the opposite extreme; and, in our endeavours to trace every thing up to tangible sources, it may be questioned whether the ideas of congestion and inflammation have not too much superseded the recognition of nervous agency.

310. Spasmodic affections, which are made to constitute the third order in the present class, are quite as difficult of explication as arè the adynamic ailments. We have assumed the deprivation of power, causing the latter to be an unknown condition of nerve, and of the spasm we may predicate the same thing; for if we admit of irregular flows of nervous fluid, as the source of those irregular actions in the fibrous part of the frame to which the term spasm is applied, we set out without any other guide than that of a petitio principii, and wander we know not whither.

311. Even the axiom that has been admitted by some to an unlimited extent 'debilitas gignit spasmum,' spasm originates in debility, cannot be received into pathology without much qualification; for when an individual is thrown down in violent convulsions from merely a few thread worms being lodged in the rectum, and becomes immediately himself again upon the expulsion of these 'minute instruments of mighty mischief,' you can scarcely say that it was weakness which caused, and it is returning strength which has subdued the disorder; though, as far as the convulsion itself is concerned, there may be some propriety in placing it to the account of debility, since convulsion consists in fibrous contraction not being brought up to the due pitch which is demanded for orderly display.

312. Among the spasmi Dr. Cullen has introduced some of his genera, in violation of his own principles. Asthma, dyspnœa, and hooping-cough, might still perhaps retain their situation without very strict investigation of right or claim; but who can see pyrosis and diabetes introduced as spasmodic disorders, without thinking that either the scheme which admits them into the class is defective, or that insuperable difficulties connect themselves with all schemes.

313. The vesaniæ are those derangements

which are commonly considered as distinctly mental. It has, however, been asserted that 'every nervous disorder is a degree of insanity;' and there is some rectitude in the notion which this sweeping assertion is meant to convey. When feeling is no more than commensurate to obvious circumstance, the individual thus feeling, or thus perceiving, is considered to be under a degree of delusion corresponding with the intensity of the affection; and in delusion consists insanity. But here lies the difficulty in determining upon the existence of insanity, that a standard of sanity is assumed which it is difficult to substantiate. What, says the author now under contribution, is motive to me is not to another; and, while I call the miser mad for loving money merely for money's sake, I in a measure forget that his feelings with regard to the value of money are absolutely different from mine; and so in respect of what are called and considered imaginary ailments. Who shall say that the despairing hypochondriac, contemplating and effecting the horrid purpose of suicide, feels or acts in less consistency with his state of sentient being than does the happy individual who gratefully participates in the blessings of providence, and does all in his power to preserve his life both from a sense of duty and a feeling of delight?

314. With respect to the altered condition of brain and nerve, upon which insanity depends, we know nothing more than we do respecting the cause of convulsive agitation, or adynamic torpor. We are fully conscious that there must be some bodily change, and that of a serious nature; for the idea of merely mental disorder, abstracted from corporeal engagement, cannot be admitted into pathology; but, of the essence of the change produced, we are often from first to last profoundly ignorant, and the suddenness with which both its visits and departures are sometimes made is inconsistent with our notions and knowledge of organic disorder. When, indeed, we meet with opportunities of examination after death, there is scarcely any condition of brain not found at one time or other; but there is a great want of uniformity in these appearances. They are most of them occasionally found when the disorder had not been insanity; and it is further impossible to say how much of the change has been cause and how much consequence. When, says our author, the vascular theorists refer all the aberrations of nerve and mind to congestive and inflammatory states, they make the same mistake here as they do in reference to pyrexial pathology, by putting the acted upon in place of the agent, and by assuming the existence of states that are incidental as if they were necessary and invariable; so again do your chylopoietic speculatists, who will have it that the stomach must be mad before the man, in the same sweeping way that they will not admit of an accidental blotch on the body's surface, without considering it an index of digestive derangement.

315. The distinction between hypochondriasis and melancholia, it must be conceded, has been too nicely drawn out upon the ground that the one is an adynamic, and the other a vesanic ailment; but that absolute madness of the melancholic cast often takes firm hold of an individual, without at all interfering with digestive integrity, must be allowed by every one who may not have committed himself beyond recall to the catholicism of the chylopoietic creed. Cullen on the other hand seems to be in an error, when he states melancholia to be partial insanity without dyspepsia, and mania to be universal madness; for the one is often as complete and universal as the other, and the difference, like that in febrile manifestation, is rather to be taken from the person affected than from the thing affecting: 'such a system of division is contrary to what manifest propriety suggests. It is making the plant, from an acorn dropped upon a rocky soil, not an oak because it does not rise to the height or spread to the extent usual to the king of the forest.'

316. The remarks of Dr. Haslam on this head are well worth the attention of the nosological subdivider. As the terms mania and melancholia are in general use, says this writer, and serve to distinguish the forms under which insanity is exhibited, there can be no objection to retain them; but I would strongly oppose their being considered as opposite diseases. In both the association of ideas is equally incorrect, and they appear to differ only in form from the different passions which accompany them. On dissection, the state of the brain does not show any appearances peculiar to melancholy, nor is the treatment which I have observed most successful different from that which is employed in mania. We every day see the most furious maniacs suddenly sink into a profound melancholy; and the most depressed and miserable objects become violent and raving.

317. The third class of Cullen is established on the assumption that a depraved condition may be present, of the assimilating or eliminating organs, without either the nervous system or the blood-vessels being primarily implicated. Such disorders, under the prevalence of the humoral pathology, were ascribed to bad humors pervading the body; a notion which Dr. Cullen has in some measure himself given into by retaining the term cachexy; but to disordered action, in the absorbent or secerning organisation, are the occurrences rather referred in the present day; and the pre-disposition to them is thought to consist in a particular susceptibility to be acted on in this portion of the frame.

318. The orders of cachexia are, marcores or emaciation; intumescentiæ or swellings; and impetigines, or those cachectic disorders which principally manifest themselves in the skin and superficies of the body.

319. Of the marcores, or emaciation, Dr. Cullen makes two kinds, the tabid and the atrophic; the one being attended with hectic fever, as a prime and peculiar accompaniment, the other being without this index of diseased state. Atrophia ought, however, in strict propriety to have been transferred to the neuroses, since the assimilating functions are supposed to be secondarily at fault in these cases of atrophic as opposed to tabid wasting, or to be dependent upon a disordered condition of the nervous system; while the tabid affections originate in some inherent or essential error in the assimilating or

secernent organs; and in these last, it is said, some indications at least of hectic disposition may for the most part be traced, as well as some intimations that a scrofulous diathesis is present. What, asks our author, is hectic? What is scrofula? and he replies to these questions in the following manner. Some individuals are so constructed, principally in reference to lymphatic organisation and susceptibility, that any cause which produces derangement, or deviation from healthy action, fastens with more facility upon this part of the frame (the lymphatic) than upon any other; and these are they, who, by common consent, are considered scrofulous—these are they moreover in whom hectic fever is soonest established, so much so, that any attentive observer may be guided in his recognition of scrofulous tendency, by the readiness which hectic manifests to start up and accompany a disorder's progress.

320. Fully marked hectic is indeed for the most part a signal that local disorganisation of a serious nature has established itself in some part of the body; and it is so general an attendant upon the suppurative process as to have led some theorists to trace its essence into reabsorption of pus, which had been poured out from the blood-vessels; but it does certainly show itself at times without any topical accompaniment, and does appear in some way or other to be especially connected with the lymphatic and secernent systems. If two children be affected simultaneously with inflammation of the brain, from the same acting cause, and one of them has more of the scrofulous diathesis about him than the other, you will in this one find a readier disposition to hydrocephalic effusion, you will find his little cheeks sooner painted by the hectic blush, and all things more rapidly tending towards a certain sort, as well as grade of disorder.

321. Fill the stomachs of two other children with food, which, both in kind and quality, shall make too large a demand upon the digestive and assimilating powers; in the one case you will have common pyrexial disturbance produced, or the infantile remittent fever of authors will be engendered; in the other you will have a knotted protuberant abdomen, a hectic circle of red on the face, emaciated limbs, and, in fact, tabes mesenterica; and why? Because in this last case the mesenteric glands, as parts of the lymphatic or lacteal system, are constitutionally obnoxious to ready derangement, and, probably, because there is not the proper absorbent process going on in the several secernents that are connected with the assimilating process; there may not merely be a deficient quantity of the biliary and pancreatic secretions, but such diminution may be accompanied by a deficient stimulant property in these secretions; besides, from the inactivity of the absorbents, the watery parts of the secretions referred to are not readily re-absorbed, and thus the duodenum receives them in too dilute a state for functional demands. The emaciation then of this child and its weakness are not induced in the same way as the weakness and want of flesh in the other. In the subjects of remittent fever, the blood vessels and nerves appear to have been more engaged with the disease, and the altogether of the morbid process has been of a different nature.

322. Of the intumescentiæ, the next order of the class, the rationale is often exceedingly obscure. When a permanent enlargement takes place of the abdomen, and we find such enlargement to be constituted by a deposit of fluid in the peritonæal cavity, we may seem to have some precise notion of the modus generandi; at any rate we are convinced that the tumefaction is occasioned by exhalation being greater than the due quantity, or the absorption less; but a tense protuberant abdomen shall often present itself, which can no otherwise be accounted for than by a secretion of air, and which protuberance shall appear and disappear in a manner as difficult to trace as in any morbid process to which the body is obnoxious. That the emphysematose, and tympanitic, and adipose, and physconic enlargements, are, however, in some sort or other dependent upon a depraved or rather deranged action in the secernent and absorbent functions, may be considered as pretty certain, and hence the propriety of their admission into this class of diseases.

323. In respect of actual dropsy, it has been just intimated that the pathology is rather more satisfactory; even here, however, opinion varies, as to the precise principle upon which the interstitial deposit is effected. Systematists have been accustomed, until very lately, to settle the account by assuming a want of due adjustment in the proportion of exhalation and absorption; and in this way connecting necessarily the idea of debility with the development of the disordered state. More recently, however, an undue accumulation of fluid, either in the cellular membrane or in any of the cavities of the body has been looked upon rather as the result of morbidly increased action—of inflammation, in fact, than of torpor, or want of excitement. In some diseases, that go under the denomination of dropsy, this assumed action has been most manifestly present, as in acute hydrocephalus, in hydrothorax succeeding to pneumonia, and in ascites to peritonæal inflammation; but it may be questioned whether we have not too precipitately changed sides with regard to hydropic pathology, and now think of action too much as before we thought too much of torpor.

324. Dropsy, says our author, appears fairly traceable to at least three sources. When you have sluggish circulation connected with, and indeed caused by, venous plethora, the overladen vessels empty themselves by means of their contiguous exhalants in a sort of percolating way; or at least without the induction of any disordered process that can justly be considered analogous to inflammation. It is this kind of dropsy that gradually supervenes upon obstructed viscera, such an obstruction causing an impediment to a free flow of blood and occasioning a remora among contiguous vessels. In this case neither are the exhalants nor the absorbents properly at fault, nor is there any inflammatory irritation causing the exudation.

325. Serous or watery accumulations at other times take place, where every thing about the patient indicates torpor, and torpor of a particular

kind, where, as it has been happily expressed by Dr. Bree, 'the last guardians of the safety of the animal œconomy give way and refuse to do the work of absorption.' In this case it would appear, that we have dropsy from direct debility.

326. Lastly, some kinds of inflammation more open or more masked (for inflammation has often existed when it has not been suspected), so implicates the arteries, which terminate by open mouths or surfaces, that they are obliged in their own defence, as it were, to throw out an extraordinary quantity of serous effusion, and occasionally something more than the mere watery portions of the vital fluid are sent through them during the hurry and commotion of the process. Even here, however, the tendency to lymphatic exudation is partly constitutional; and it will be found that, from first to last, there is more disposition to hectic production than is common to ordinary inflammation.

327. Whether a fourth cause of dropsy may be put down, viz. actual tenuity of blood brought on by hæmorrhage, as expressed by Dr. Cullen, seems, to say the least, problematical. The blood certainly may be, and often is, deficient in its due proportion of solid to serous part; but whether this constitution in itself would tend to serous effusion seems doubtful. In this, as in all parts of medical theory, we should be careful to avoid the error of looking for one principle and source of affections that may be dependent upon a multiplicity and variety of causes; and we should likewise be careful, when we reject old theories, not to suppose that the one diametrically opposed to the rejected one must be true.

328. Rickety deformity, one of the genera of the present order, it would not seem very difficult to account for. During infancy one of the main duties of the exhaling or secerning vessels is to throw down calcareous matter into the cartilages and osseous membranes, so as to form bone. See PHYSIOLOGY and BONE. But, when the blood from which the bony matter is manufactured is not duly fed with repeated supplies of well-formed chyle, the consequence is a failure in quantity and kind of deposit; or it may be that, from some vice in the re-absorbing energy, the same effect is more indirectly brought about; and, in this last case, we may have undue or irregular ossification, even when the blood abstractedly may not be in fault.

329. Of the third order in the class impetigines, scrofula is the first genus, on which some remarks have already been made. To say that scrofula consists of a peculiar condition of the lymphatic vessels and glands is not to say much in the way of exposition as to its absolute essence, but much more we cannot perhaps say without treading on hypothetical ground; to the immediate circumstances, however, connected with lymphatic and glandular derangement scrofula does not seem to confine its workings. Madness itself is often of scrofulous origin; and in this case, of course, the nervous system is unequivocally implicated in the disorder; but still, even here, there is something by which you seem convinced of the more than common connexion between the production of the malady and the derangement of those organs to which scrofula more especially appertains: you may even here, it is said, trace a tendency to hectic irritation, and the altogether of the case will tell you that the evil is of a peculiar, not of a common nature. It ought, however, to be noticed, that the scrofulous diathesis is marked by considerable variety in respect of degree. There are scarcely any individuals in Britain without exhibiting some slight tokens of its making up part of their constitutional stamina, while it is in some so conspicuously manifested as to be obvious to the most superficial observer.

330. Of syphilis, the second genus of the order impetigines, we shall not say any thing in this place, as its history, peculiarities, and treatment, will be considered in the article SURGERY. Scurvy is principally confined to marine situations and circumstances. It seems to consist of a broken down, or in some way vitiated, condition of the blood, connected for the most part both with a primary and consequential derangement in the nervous power, and is thus very different from scrofula—the one being, so to say, more sanguineous, the other more glandular or lymphatic.

331. Elephantiasis, lepra, frambœsia, and trichoma, are the four succeeding genera of this order; but as these are cutaneous complaints, and as Dr. Cullen may be considered particularly defective in his notions and arrangements of skin disorders, we shall defer any remarks on them till we come to treat especially of the ailments which affect the surface of the body. Icterus (jaundice) is also placed here, but most evidently misplaced: for that an accidental obstruction of the bile passages, causing the fluid destined for one part of the system to be thrown upon another, should be put down to the score of bad habit would seem, in every point of view, to be highly inconsistent with the principle of the classification; but it becomes more obviously and especially so when the term cachexy is meant to predicate a morbid susceptibility, or disordered excitation of the secernent, assimilating, or glandular organs.

332. Cullen's fourth class, as the reader will see by turning to the nosology, comprises local affections; there is, however, a good deal of objection to the very notion of topical as opposed to universal ailment, and it has been made a question whether the idea of locality, independent of external irritation, may not be based upon a wrong foundation, there being such an intimate and pervading connexion among the several constituents of an organised body, that the isolation thus assumed cannot be fully substantiated. In the first order of the locales, viz. the dysæsthesiæ, comprising affections of the senses from vitiated organs, as caligo, amaurosis, dyspepsia, &c., we often positively know, and may for the most part positively infer, that the local is but an accidental expression of systematic or general evil. Then, again, among the dysorexiæ or depraved appetites, with what propriety, it is asked, Can anorexia and bulimia be regarded as partial derangements, while dyspepsia is considered a universal affection, even although this last, by the admission of Cullen himself, is sometimes consequent upon a disease ipsius ventri-

culi? Our author concludes these preliminary remarks by saying that, between nymphomania and nostalgia, which are placed by Dr. Cullen in his class locales, and in immediate succession as to order, no further connexion can be traced than in their commencing letter; and upon this principle nosology and nonsense are as nearly allied. To call 'a vehement desire of revisiting our native home,' which is the definition of nostalgia, a local affection, would seem indeed totally inconsistent with any other notion than that of an obscure anticipation of organological or phrenological doctrine.

PART IV.

PRACTICE.

Class I.—Pyrexial Affections.

333. Order 1. Fevers. The general divisions, it will be observed, of the febrile order of diseases, are in the first place into intermittent and continued; the subdivisions being, of the intermittent, the tertian, quartan, and quotidian, with their several varieties and admixtures; and, of the continued, the inflammatory or synocha, the typhoid or low fever, and the synochus or mixed; to which is added in the nosology hectic fever. We shall not of course repeat the definitions which are given in the nosology, but proceed to remark generally and individually on symptoms, peculiarities, causes, diagnosis, prognosis, and modes of treatment.

334. *Symptoms of intermittents.*—Intermittent fevers are characterised by a decidedly marked cold stage, in which we find rigors, paleness, collapse, short and obstructed respiration, chattering of the teeth, trembling of the limbs, and rough or contracted skin called goose skin, with a general shrinking of the features, and a small and frequent pulse. These symptoms continue for a longer or shorter period, and are then succeeded by those of the hot stage, which however is at first of partial and irregular occurrence; and at length the heat becomes universally diffused, and is much above the standard heat of health. Fulness likewise takes the place of the previous collapse and shrinking; the pulse from being small becomes fuller and harder; pains are felt in different parts of the body and limbs; nausea and vomiting are not unfrequent; the urine is high colored, but small in quantity; the breathing is hurried; there is considerable headache and throbbing of the temples; confused perception and thought, and oftentimes delirium; the tongue now becomes covered with a white crust, and thirst prevails. After these symptoms have continued for some time a moisture breaks out on the forehead, face, and neck, which soon extends universally; and now the heat and thirst abate, the urine from being high colored and scanty comes to be more copiously discharged and to throw down a sediment, the pulse becomes more free and natural, the throbbing of the head subsides, the respiration becomes less labored, and in a word, all the functions are restored to their wonted condition. The whole of this process usually takes up from six to eight hours.

We have above remarked that the tertian, the quartan, and the quotidian, are the most frequent types, as it is expressed, of intermittent fever. By this is meant, that, in the case of the tertian, forty-eight hours elapse from the commencement of one fit of fever to the commencement of another; that the period of the quartan is seventy-two hours, and of the quotidian twenty-four. The most common type is the tertian, which is the occasion of its being marked first in the nosology: this principally occurs in the spring. The quartan, which is the most severe form of ague, usually occurs in the autumn: this has generally the cold stage the longest, while the tertian has for the most part the longest hot stage.

The subdivisions and intermixtures of types we need not, as above intimated, follow; but it is necessary to remark that, while the true intermittent or ague leaves the patient in the intervals of the fits quite free from febrile disorder, there is a form of fever which is neither properly intermittent, because it does not thus go off completely; nor properly continued, because the intervals are marked, but not with distinctness: this kind of fever authors have therefore agreed to designate remittent. It is further necessary to notice that these types of fever change, tertians and quartans become quotidians, and the quotidian falls into the remittent; and this change in the general way is rather favorable than not, inasmuch as it is for the most part from a severer to a milder form. Climate very much modifies the types and circumstances of intermittent and remittent fever, and the different seasons have likewise a considerable influence upon the types of the disorder. It is in countries where heat and moisture prevail conjunctively that the remittent form of fever is the most common.

Agues often last, if not arrested by medical treatment, for some length of time, and often terminate without producing much organic mischief; but they occasionally give rise to chronic obstructions of the viscera by their continuance, more especially of the liver and spleen, enlargements of which last organ used formerly to be well known under the denomination of ague-cakes; dropsy also is an occasional sequela of intermittent fevers; but these seem rather to be produced in an indirect way, and to follow upon primary derangement and chronic obstruction of the viscera.

335. *Causes.*—The predisposition to be affected by the exciting causes of ague are, weakness of body, whether constitutional or induced by large evacuations; unwholesome diet; long watching; exposure to the cold and damp of a night air; mental depression; and, in fine, whatever tends to debilitate or derange the frame. And it is to be observed, that this predisposition is increased by habit, that is, a person having once had the disorder is more likely afterwards to have it excited by its particular and specific source, or perhaps to fall into it in consequence of exposure to cold and damp, or subjection to circumstances which are generally regarded as merely circumstances of predisposition, but which some consider actual excitants of the disorder. We may further remark that this law of habit is different from that which applies to the continued forms of fever, especially those which manifestly acknowledge a specific poison as their

source; for the effect of these is rather to lessen than increase predisposition, an individual being much less obnoxious to their influence after having once been the subject of them. This in some cases is carried almost to the extent of complete insusceptibility to a second attack.

Respecting the actually exciting causes of intermittent fevers, or agues, we may refer to what has been advanced in our introductory remarks (see par. 290); in which it will be seen that a difference of opinion prevails on this head, some supposing that a particular poison engendered from the decomposition of marshy lands is absolutely necessary for the production of ague, or even remittent fever; while others contend that, so far from marsh miasm being necessary to the excitation of intermittent, we have no evidence that such poison ever operates, or even exists. In addition to what has been advanced on this head, we shall here beg leave to introduce the remarks of a modern and luminous writer, Dr. George Gregory, to whom we shall become more indebted for quotations and extracts as we proceed in our disquisition.

The great and important occasional cause of intermittents, says Dr. G., are the effluvia arising from marshy grounds, and called by physicians marsh miasmata. It is certainly a curious fact that this pathological principle, so obvious and so important in its practical tendency, should have been unknown, or at least unnoticed by the older medical authors. Sydenham seems to have had a glimpse of it, but he could not have seen it in its true light, for in his fifth chapter he attributes agues to the ebullition of spirits and viscid juices. Lancisci is the original writer on marsh miasmata. His treatise is entitled De Noxiis Paludum Effluviis. We are not, however, yet acquainted with all the circumstances upon which the production of ague depends. It is presumed, however, that the miasmata arise from the combination of earth and moisture with putrescent vegetable matter. Moisture alone, though ever so abundant, will not produce ague; for it is a rare disease at sea, even upon the foggy banks of Newfoundland. When the marsh is covered by water, agues are less frequent. Of the exact nature of these miasmata we are ignorant, but some points have been noticed with regard to them to which it will be proper to advert.

The most elevated parts of a marsh being always the healthiest, it is imagined that the miasmata are comparatively heavier than the atmospheric air. There is reason too to believe that they cannot be wafted by currents of air to any great distance from the spot where they were generated, but on this point some differences of opinion have lately prevailed. The calm months of the year being the most productive of agues, it is reasonable to suppose that the miasmata are most powerful when concentrated, and that diffusion by a brisk wind renders them comparatively inert. Culture and proper draining prevent their formation, and hence it is that intermittent fevers are so much less frequent in England at present than they formerly were. A very short exposure to the exhalation of a marsh is sufficient to affect the system. Travelling through the Pontine marshes has often been followed by an attack of ague. There is considerable diversity in the period which elapses between exposure to marsh miasmata, and the invasion of the disease. It sometimes does not exceed a few days, but there is reason to believe that the latent period has occasionally extended to several weeks or even months.

But, though it cannot be disputed that marsh miasmata are the most frequent and important existing causes of intermittent fevers, still it would be impossible to deny that it has others. Febrific miasmata may unquestionably arise, under particular circumstances, from almost any soil. Persons residing in very healthy parts of London are occasionally attacked by intermittent fever. In the time of Sydenham, agues were common in every part of the metropolis. To the great attention which is now paid to the sewers we are probably in a great measure indebted for the present healthiness of the town, and particularly for our exemption from ague. The occasional occurrence of the disease, therefore, at a distance from marshes, is not to be a matter of surprise. Agues prevail extensively in certain districts where there are no marshes; but then it will always be found that there is something equivalent to a marsh. There is either a subsoil of such a nature as does not allow water to penetrate easily through it; or there is a great extent of wood impeding thorough ventilation and the action of the sun's rays; or there is total inattention to drainage and culture. In one or other of these ways we may be able to explain the prevalence of ague in the uncultivated parts of America, and in many parts of Italy, particularly the neighbourhood of Rome, Naples, and Syracuse.

These peculiarities of soil are not merely the occasion of agues, but they serve to modify the characters of continued fever, and of any other febrile disease which may happen to occur in the district. They give a tendency to exacerbation and remission in the symptoms of the fever; and it is not improbable that many cases of what might be considered genuine remittent fever from marsh exhalations, are in fact cases, of common continued fever from cold modified by peculiarities of soil.

We may add that there is still much that is obscure with respect to the actually producing causes of intermittents; these forms of fevers, after having been almost unknown in the metropolis for many years, have within these few past months been comparatively frequent here; a fact which should seem inconsistent with the notion of marsh miasmata, which generally obtains: indeed there is every reason for the inference that much of disease-creating and disease-modifying circumstance has reference to atmospherical variations which have hitherto been altogether undetected excepting in their effects.

336. *Prognosis.*—In Britain, and in other countries in the north of Europe, agues are for the most part unattended with any immediate danger; but the disorder is apt, as above intimated, under unfavorable circumstances, or injudicious treatment, to give rise to visceral obstructions, and their consequences. In some parts of Africa agues are diseases themselves of great danger, without reference to their interme-

diate consequences; and in all cases we may say of the disorder, that its prognosis will be greatly regulated by climate, soil, and season. When the fits are of short duration, and regular recurrence, a speedy or an interrupted solution of the malady may be looked for; but when they are of long continuance, and accompanied with structural derangement, or even of very violent affection of function, the disorder is likely to continue for some time, and its termination in health will be doubtful.

337. *Treatment.*—The obvious indications are to abate the violence of the fit; and, when the fit has subsided, to endeavour at preventing its recurrence.

During the cold stage, warm diluent drinks may be given; warm fomentations applied to the legs and feet; or the patient may be immersed in the warm bath should the symptoms be very violent; and cordial diaphoretics may be administered.

℞ Ammoniæ subcarbonatis grs. viii.
Liquoris ammoniæ acetatis f. ʒiij.
Syrupi aurantiorum f. ʒij.
Aquæ puræ f. ℥j.
Fiat haustus.

That is, Take of subcarbonate of ammonia eight grains, liquor of acetate of ammonia three fluid drachms, syrup of orange peel two fluid drachms, water one fluid ounce for a draught.

When the hot stage is fully set in, saline and cooling medicines are called for, with acidulated drinks; and now it will be proper likewise to give diaphoretics, of which one of the best, when the irritation runs very high, is a small dose of tartarised antimony, as in the following formula:

℞ Antimonii tartarizati gr. ⅙.
Aquæ puræ f. ℥iß.
Fiat haustus.

That is, Take of tartarised antimony one-sixth of a grain, and water a fluid ounce and a half, for a draught; or a solution of half a scruple of nitre (potassæ nitras) may be administered in a draught of water; or the common saline draught, either in a state of effervescence, or when the effervescence is over. The effervescent saline draught is made by mixing a scruple of carbonate of potass (salt of tartar) dissolved in a fluid ounce of water, and sweetened by sugar, with half an ounce of lemon juice, or, what is quite as good, fifteen grains of the concrete citric acid. Some practitioners give opium in the hot stage, to the extent of from thirty to sixty drops of the tincture, about half an hour after its accession; others recommend a fluid drachm of sulphuric ether for the same purpose of shortening the fit, abating its violence, and hastening perspiration. Bleeding too has been recommended, especially where the irritation of the hot fit runs high, or the inflammatory diathesis is conspicuous. Saline purgatives may at this time also be exhibited should constipation accompany heat; and there is no better aperient on these occasions than from half an ounce to an ounce of Epsom salts (magnesiæ sulphas) dissolved in camphorated mixture. In short, the treatment of the hot stage of intermittent fevers is pretty nearly the same as the treatment of continued fever, marked by irritative or inflammatory excitement; and to heat in the cold stage, and cool in the hot stage, are the plain indications of nature. Some practitioners administer, immediately before the accession of the cold stage, an emetic, with a view of producing such an impression upon the system as to interfere with the full development of the febrile action, and some give tincture of opium at this time, with the same intention; so that it will be recollected that opium is given by different individuals, both in the cold and hot stages.

For the purpose of accomplishing the second indication, viz. preventing the disorder's recurrence, remedies are had recourse to in the intermission, and of these emetics, purgatives, Peruvian bark, arsenic, and forcible impressions made upon the nervous system, are the principal. For an emetic, a scruple of the sulphate of zinc may be given, dissolved in water; and the purgatives at this time of the apyrexia should be rather of the resinous than saline kind. A fluid ounce of the compound decoction of aloes, with the same quantity of infusion of senna, will make a good aperient draught, and when decided marks are present of obstructed viscera, or disordered condition of the alimentary and intestinal canal, mercurials may be joined with the purgatives that are administered, and by the exhibition of them the system will be better prepared for bark or arsenic. Five grains of blue pill at night, succeeded in the morning by the above-named purgative draught, and these repeated two or three times in the course of the week, will constitute a good preparative or accompaniment of bark, which given without these deobstruents, as they would be called by the Boerhaavians, might, while it cures the complaint, tend to facilitate the visceral infarctions above referred to.

Bark should for the most part be given when the system is entirely free from pyrexia; it may be administered in drachm doses every third or fourth hour, or even oftener if the stomach will bear it; so that several doses may be exhibited during the intermission; the following draught may be substituted.

℞ Extracti cinchonæ resinosi grs. xv.
Tincturæ cinchonæ compositæ f. ʒij.
Syrupi aurantiorum f. ʒi.
Decocti cinchonæ f. ℥iß.

That is, Take of extract of bark fifteen grains, compound tincture of bark two fluid drachms, syrup of orange peel one fluid drachm, decoction of bark a fluid ounce and a half; for a draught.

As an excellent substitute for bark in those large quantities, the modern concentration of it, beginning now to be well known under the name of the sulphate of quineric, may be administered with much advantage. Of this two grains may be given instead of the bark powder or draught, made into a pill with a small quantity of crumb of bread, or thick mucilage; or it may be made into a draught with water and two or three drops of the diluted sulphuric acid. The medical practitioner, who has not hitherto

been in the practice of employing this medicinal, will often be surprised at its prompt efficacy, both in intermittent fevers, and in other cases where considerable quantities of bark are indicated, but where the stomach is scarcely able to receive the necessary quantity in the form of powder, decoction, or extract. It should be observed that, when the extract of bark is employed with a view of giving the medicine in large doses, the resinous extract, or that made with spirit, is much superior to the aqueous, as by the action of the spirit a part of the bark is taken up which is not soluble in water.

When arsenic is administered to cure intermittent (which for the most part is more efficacious, at any rate, than the old forms of bark), the liquor arsenicalis of the London Pharmacopœia should be employed. This is an arseniate of potass, and often proves promptly and decidedly efficacious in preventing the recurrence of the febrile paroxysms. It may occasionally be employed with tincture of opium in the dose of five minims of the former to three or four of the latter. Under proper management, says a modern author, arsenic will be found to be the most generally useful of all the medicines which have been recommended in the treatment of agues. The best mineral substitute for it is the sulphate of zinc, which is largely employed in the fenny counties of England. It is given in doses of one or two grains three times a day, and is very highly spoken of.

A strong impression made upon the imagination of the patient will sometimes break in upon the habit of the disorder, and at once dislodge the malady, which shall have seemed reluctant to give way to the common remedies. Charms have often proved efficacious; and it is not necessary to say that their operation is upon the principle now adverted to.

While the secretions are kept in good order by the administration of purgatives and mercurials, to which, by the way, the taraxacum (dandelion) may be occasionally added with advantage; a generous diet, and the moderate use of wine, will be found requisite during the absence of the paroxysms. These too are good preventives of the malady, especially after a patient has been the subject of an attack.

Remittent fevers are to be treated upon the same general principles with intermittent and continued. These are types of fever which, as above intimated, are very common in counties where there is a combination of heat and marshy exhalations, or humid atmosphere. Their varieties, from endemial causes, and local circumstances, and constitutional peculiarities, are almost endless. They are, however, for the most part characterised by an excited or disturbed state of the biliary functions, and on this account especially call for medicines which act as an emulgent to the liver; but we shall have further to speak on this head, when considering that form of disease which has been termed yellow fever.

338. *Continued fevers.*—The student, by turning to the nosology, will perceive that Dr. Cullen's system recognises three forms of continued fever; but it will be right to take these, as all other divisions in medicine, merely as arbitrary or conventional, and to recollect that, although the definitions are as accurate as definitions can be, the practioner must expect to find endless varieties and modifications. We shall in this section, as we have done in that devoted to intermittents, first treat of the general symptoms of fever, then of their causes, prognoses, diagnoses, and management.

Symptoms of continued fever.—Lassitude, languor, and anxiety, followed by rigors, which are again succeeded by partial, and at length universal, heat; indeed, the history of a paroxysm of intermittent fever is, in some sort, a description of continued fever; but, for the most part, there is in these last more of animal depression and sensorial disturbance than is the case in intermittent fever. A very great prostration of strength also, in the general way, marks the commencement of continued fever, though in respect to the degree of this symptom there is found very great variety; and in some cases the powers seem rather obstructed or oppressed than actually exhausted; indeed, this particular may be received as one of the differences between positive debility and the peculiar debility of fever—that in the latter there is an indisposition to exert power—while in the former there is the inclination without the ability. The pulse in fever becomes more frequent than in health, and it wants also the freedom of health; it is oppressed, and if the fever be what is called inflammatory, or marked from the onset by very high excitement of the vascular system, there can be recognised a hardness as well as obstruction about its beats; this hardness, however, is more conspicuous when the fever is what is called symptomatic, that is dependent upon actual inflammation of some one organ. It should be observed that the symptoms of continued fever, especially of the fevers that are met with in this country, are often of gradual and almost imperceptible invasion. You cannot always draw the line of demarcation between health and disease; the patient is often unwell rather than positively ill for some days; and the young and inexperienced practitioner must not condemn himself for being less skilful and observant than others, should he fail to anticipate the full formation of unequivocal fever, from having seen the patient during the time and circumstances now referred to. When, however, there is continued languor and depression, especially if it be attended with confusion of thought and general difference of perception from what is the case in health—when these symptoms are accompanied by an altered state of pulse, by pains of an obscure and wandering kind about the limbs, by sighing, or hurried or obstructed breathing, by a peculiarity in the expression of the countenance, especially of the eye, this last organ being sometimes dull and dim, at other times morbidly sensible to the light; and the vessels of the tunica conjunctiva injected with red blood—when in addition to these symptoms the tongue becomes furred, the skin hot, shrivelly, and dry, the urine scanty and high colored, and the bowels torpid or irregular, we may be pretty certain that fever is about to establish itself; and

the particular nature of the fever will be usually designated by the prominence of one or two characteristic marks; thus in the plague, which according to Dr. Cullen's classification would be a typhus gravior, the most marked of all the early symptoms is the extreme prostration of the strength, and the staggering of the individual attacked, and in the course of the malady buboes become its characteristic; while, in the yellow fever of the West Indies, typhus icterodes, the yellow color of the skin, the buboes, derangement, and the black vomit, are the prominent features of the distemper.

339. *Causes of continued fever.*—On this head we must refer to our proem, as we did in the case of intermittent fever, where it will be seen that a difference of opinion still prevails on the excitants of the febrile state, one party supposing that no case of genuine fever of any continuance can have place without the operation and influence of a certain morbific poison which is peculiar to itself; another going to the opposite extreme of supposing that contagion is a mere imaginary power, and, while it is supposed to operate so as to communicate the malady, that the communication has, in point of fact, been from the air and circumstances of the place; while a third, and moderate party, think that we have sufficient evidence for the existence and operation of a poison in fever, but that the action of this poison is not, so to say, abstract and exclusive, that is, does not display its effects independently of the soil and atmosphere, and other circumstances of place, and that the disorders themselves, in which this poison is engendered, and by which they are propagated, may originate at times spontaneously. All parties, indeed, acknowledge that some distempers are directly and absolutely dependent upon a specifically exciting cause, and the disputes in some measure resolve themselves into the extent or limitation of this specific causation; whether, for instance, the plague of the Levant, and the yellow fever of the West Indies, originate and are communicable in the same manner as are small pox and measles.

As considerable importance is attached to this enquiry, we shall in the present place add to the remarks made in the preliminary portion of the present article, the following quotation from Dr. Gregory, which, in our judgment, contains as clear and distinct an account of the subject in dispute as any we have met with. After speaking of cold and atmospheric alternations of temperature as causes of the febrile state, Dr. Gregory, the author to whom we now refer, goes on to say—'Continued fever, however, has another and a very important exciting cause, which frequently operates where neither cold nor alternations of atmospheric temperature can be suspected, as where fever attacks persons shut up in close rooms with others laboring under the disease. When fever appears under such circumstances, it is said to have its origin in contagion.' A number of the most important doctrines in the science of pathology are closely associated with the subject of contagion. From the earliest periods at which it became an object of enquiry this has been acknowledged, but the investigation is obscure and difficult, and has proved a source of endless controversy. Many of the disputed points in medicine are interesting only to the man of science, but the doctrines of contagion are of general interest, because involving practical considerations of the highest importance. Without attempting to clear up all the difficulties in the way of the enquiry, I shall be satisfied with a brief enumeration of its leading positions, and of the principal points in dispute.

1. Attempts have been made to throw discredit on the doctrine of contagion as the cause of fever, by showing that it was for a long time either unknown to or discredited by physicians. It is certainly a curious fact that, for the first dawnings of information concerning it, we are indebted, not to Hippocrates or Galen, but to ancient poets and historians. Thucydides, in his account of the epidemic fever or plague that raged in Athens during the Peloponnesian war, shows that he understood contagion in the sense in which we now use the term; noxious matter from one body producing a similar disease in another. In Plutarch's life of Pericles, we read that, whilst that commander was laying siege to the city of Epidaurus, a distemper prevailed in his army, which not only carried off his own men, but all that had intercourse with them. Livy, in the account of a camp fever which affected the armies of the Romans and Carthaginians at the siege of Syracuse, distinctly states that it was propagated by contagion:—'Postea curatio ipsa et contactus ægrorum vulgabat morbos.'

Virgil and Lucretius employ the term contagion to express the manner in which a disease of sheep spread among the flock. Medical writers were for the most part very inattentive to contagion, until the time of Sydenham, in whose work (sect. ii. cap. 2), a distinct reference to contagion may be met with. Boerhaave and the followers of his school were very incredulous on the subject of contagion. Their ideas about it too were very imperfect and confused, from the circumstance of blending the notion of contagion with that of marsh miasmata. Dr. Huxham, Dr. Lind, and Sir John Pringle, are the great original writers on contagion, particularly on that of continued fever. Since their time the subject has undergone the most rigid examination, and, as we have said, has given rise to the most discordant opinions.

2. Much confusion has been introduced into the subject of contagion by the employment of the term infection, and by the different acceptations in which contagion and infection have been taken. This has been increased from the want of proper attention to the distinction between common contagion and specific contagion. Of this last kind are small-pox, measles, the plague, and syphilis. Diseases which, occasionally produced by contagion, are yet sometimes owing to the operation of other causes, are said to arise from common contagion; of this kind are catarrh, erysipelas, ophthalmia, and typhus. The laws of common and specific contagion are in many respects similar, but they have also their points of difference.

3. In the last paragraph, that has been as-

sumed as an established principle, which has been and still is made the subject of keen dispute, viz. that typhus fever does originate from contagion, and that it is of the kind which we have called common in opposition to specific contagion. Both those points have been called in question. By a few, and happily a very few, it has been contended that the notion of a contagious origin of typhus fever is altogether unwarranted; but the views of these anti-contagionists are so completely at variance with the generally received opinions of medical men, and so irreconcileable with facts obvious to all mankind, that any formal refutation of them is unnecessary. On the other hand there have been, and there continue to be, physicians who believe in the exclusive origin of typhus from contagion, who maintain that no disease can propagate itself by contagion, which had not its own origin in contagion; in other words, who deny that common continued fever under any the most adverse circumstances can ever spread by contagion. This opinion involves the difficult, but for the most part idle question, how contagious fevers are originated; but, setting this aside, it may fairly be argued, that it is neither borne out by observation nor by reasoning. There is nothing improbable in the supposition that what originated in cold may be afterwards propagated by contagion. It violates no established law of the animal economy. Experience, on the other hand, appears to favor it; and it may therefore be laid down as an important practical principle, that fever which originates in the first instance from common causes, may, under certain circumstances either of local situation or constitution of body, spread by contagion. What these particular circumstances are may be imagined from what has already been said. The principal of them are crowded and ill-ventilated apartments, want of cleanliness and comfort, a close and sultry state of the atmosphere, and previous weakness of the affected individual, whether owing to excessive fatigue, or an improper or scanty diet.

4. Many of the controverted points in the doctrine of contagion hinge upon this question, but there is another of almost equal importance involved in their decision. Sydenham long ago argued it with much force of argument, and a due attention to his observations might have prevented much of the controversy which has lately taken place on the subject of the plague and yellow fever; I mean that particular constitution of the atmosphere which disposes to, or which checks the diffusion of febrile contagion. A malignant contagious disease, when once it has got footing in a populous city or district, does not go on to the destruction of all the inhabitants. Several circumstances contribute to this: first, peculiarities of constitution, which occasionally secure an individual completely from the influence of contagion; secondly, the immunity from future attacks, which, in several instances of febrile contagious diseases, is afforded by its having been once undergone.

These two circumstances certainly contribute to explain the fact just mentioned, but they are not fully adequate to the effect. A certain constitution of the air, therefore, sometimes favoring, but sometimes checking, the diffusion of contagion, must be admitted as a third general principle upon which it depends. Some physicians have pretended to find fault with this multiplication of causes for explaining a single phenomenon, and have argued that a peculiar, or, as Sydenham says, an epidemic constitution of the air, is alone capable of explaining what others refer to the combined operation of it, and of the principle of contagion. As well might they argue that the tree could be reared without the seed, because a peculiar condition of soil is required for its reception and growth. Several of the most important facts in the histories of great epidemics, particularly the plague, will hereafter be illustrated by a reference to these fundamental doctrines in the laws of contagion.

5. Much speculation has taken place among medical authors, regarding the mode in which contagion produces its effects in the animal economy. It has been observed, of a number of diseases notoriously arising from contagion, that they exhibit even from an early period symptoms of great depression of nervous energy, or of collapse. This is exemplified in the cases of plague-typhus, cynanche maligna, influenza, erysipelas; and it has been imagined that there is in the nature of contagion something which is directly sedative or depressing of the nervous energy. A more extended view of disease would show the fallacy of this as a general principle. Measles and ophthalmy, which yet exhibit all the marks of genuine inflammatory excitement, are diseases as obviously arising from contagion as plague or typhus. The operation of contagion may possibly be upon the brain and nerves, but its precise effect upon them is altogether inscrutable. Still, while a caution is offered against assuming as a principle of pathology any thing sedative in the nature of contagion, we must be insensible to the importance of the fact, that cases of disease arising from common contagion, above all continued fevers, are more likely to be of the low typhoid kind, than such as are attributable to cold, or other causes independent of contagion.

6. Of the intimate nature of the contagious particles which arise from morbid bodies, and which produce a like disease in others, we know nothing; but there are a few particulars concerning them which are known, or conjectured, which it will be proper to notice.

Great attention has been paid by Dr. Haygarth and others to determine the distance to which the noxious effluvia extend, and at which they operate in exciting disease. There is reason to believe that this varies in different cases, and that the plague, typhus, and small-pox, have in this respect each their respective laws. The subject, however, does not appear to have been yet investigated with sufficient accuracy to enable us to lay down any established points of doctrine with regard to it. It is not, for instance, known how far the sphere of contagious influence is affected by ventilation. In the case of continued fever, we are warranted in saying that a free circulation of a pure and cool air renders the contagious particles comparatively inert, even if it does not altogether prevent their formation. Some physicians have extended their views fur-

ther, and have maintained that there are certain chemical substances that have the power of decomposing contagious effluvia, or at least of rendering them in some way or other innoxious; of these the principal are acid vapors, particularly those of the nitric and acetic acid, and chlorine. Fumigation has therefore been recommended as a powerful means of counteracting contagion. The theory upon which it has been introduced is exceedingly doubtful, and the practice, far from being generally applicable; acid vapors of all kinds being more or less injurious to breathing. If fumigation is adopted as a substitute for thorough ventilation it may prove injurious: if only superadded, it is perhaps superfluous; but, on a point of such practical importance, it is right to speak with much caution.

The next subject of enquiry which the general doctrine of contagion offers is the attachment of contagious particles to certain bodies, thence called fomites, where they may lurk for a very long period of time and subsequently renew the disease with all its former and even increased virulence. It is the most curious fact in the history of contagion, and one established upon the most unquestionable evidence. The principle appears to be of more general application than any other which the doctrine of contagion involves. The plague and typhus, small-pox and scarlet fever, ophthalmia and porrigo, afford the most familiar illustrations of it; but it is doubtful if there is any species of contagious disease which may not be communicated through the medium of fomites. They may either be hard or soft bodies. The walls and wainscoting of the room, the bed and bed-furniture, the furniture of the rooms, and the clothes of the patient, are those against which we are to be chiefly on our guard.

It is well ascertained that the clothes of an individual, who is himself unsusceptible of the disease, may become the fomites of its contagion. In this manner typhus, small-pox, and plague, are not unfrequently disseminated.

Attempts have been made to ascertain the period of different diseases at which their contagion is most active, and that at which the body ceases to afford contagious matter. This point it would be of much importance to determine, as it would indicate when a patient might safely be permitted to mix in society; but unfortunately there do not appear to be sufficient data to enable us to decide the question with any degree of accuracy.

340. *Prognosis in continued fevers.*—The favorable symptoms in fever are in the first place the pulse not mounting very high above the ordinary standard in respect of numbers. Dr. Heberden, whose opinion of the pulse was different from many others, and who thought that very little notice need be taken of it beyond that of its greater or less frequency, considered that there was always something to be apprehended if the pulse continued regularly at more than 100 beats in the minute; and although many patients recover whose pulse, from first almost to last, is much higher than this; and, although the mode as well as the number of pulsations seems to demand somewhat more of recognition than Dr. Heberden was disposed to admit, we should say that it certainly is an unpleasant and an unfavorable circumstance in fever to find the arterial beats steadily above 100. It must always, however, be taken into account that much depends upon the constitutional proportion of healthy pulse in the individual affected; scarcely is it necessary to say that if the subject of fever has had, while in health, an average pulse of from eighty to ninety in a minute, the increase to 100 in him is not of such unfavorable import as had the natural pulse been only seventy. Another favorable circumstance is the absence of hardness, or wiryness, or obstruction, in the pulse; for, when these conditions of the arterial beats are present and prominent, they denote both an indisposition in the febrile state to give way, and are often likewise marks that some internal organs are more especially engaged with the disordered condition; hardness of pulse generally indicating local inflammation, while obstruction, and want of freedom in the beats, points out, perhaps, an unequal circulation, and a gorged or congested state of some parts of the system. We make use of the word, perhaps, because there is some degree of hypothetical inference in the idea of congestion, as opposed to inflammation, and because some pathologists will not allow the presence of fever without the presence at the same time of inflammation. At any rate a soft and free pulse, as well as one of less morbid frequency, is a good symptom. Respiration, from having been oppressed and hurried, and obstructed, becoming free, is likewise a favorable sign. The urine depositing a large sediment looks well; the tongue becoming moist at its edges is a favorable indication. Warm and general perspiration, as opposed to partial and irregular sweats, are good. Local tendencies in the fever, such as breakings out about the mouth, are often favorable symptoms; the countenance remaining unchanged argues well, as also does, more especially, the absence of delirium; the position of the body is also of importance to attend to; for, if it does not much change from that of health generally, there is room, as far as this particular is concerned, for hoping a favorable termination. Deafness has been considered a favorable sign, especially in fevers of a low or typhoid character; and, though it may be difficult to say why it should be, there does seem to be some foundation for the belief.

The unfavorable symptoms, it is scarcely necessary to say, are positive and negative, the absence of good being the presence of bad; but there are some degrees which are of unequivocal and positive kind, and which in proportion to their extent and degree denote danger. Much delirium, whether of the high phrenetic kind, or of the low muttering cast, is an exceedingly bad sign in fever, as it denotes a great deal of general derangement, and often points out a considerable extent of cerebral affection; hurried and laborious respiration is also bad, whether the derangement be merely functional, or whether it be attended with marks of pulmonary inflammation, or obstruction; on one account, indeed, the former species of respiratory disorder is the worst, inasmuch as it implies a great extent of general disorder. What authors call subsultus tendinum is always considered a bad omen; it is that invo-

luntary twitching and motion among the tendons and muscles, particularly about the wrist, which you often witness, and which manifests a great deficiency of muscular, and therefore of nervous, power. A picking about the bed-clothes, as if to remove something that offends the eye, is a bad omen; it shows the brain and the perception to be in a state of considerable derangement, and the degree of danger is often dependent upon the measure of cerebral disturbance. A very great prostration of power marked by lying on the back, rather than on the side as in health, and by sliding gradually down to the foot of the bed is one of the bad omens in fever. A collapse and sharpness of feature is proverbially so. An indisposition or incapacity of putting out the tongue when the patient is requested to do so is always unfavorable, as it denotes either want of power, or want of consciousness, or a mixture of both; the tongue being covered with a thick black border may be also taken as an unfavorable symptom; a tense, drummy, or unequal, feel of the abdomen, in place of a soft and yielding condition of it, looks ill; this mark, with several others here noticed, will be found in the historical part of the present article as generally a bad indication of disorder, noticed by Hippocrates, and it is always highly worthy of observation; fœtid excretions and intestinal evacuations of a very offensive odor prove a considerable derangement in the assimilating and chylopoietic functions; and when the urine and fæces pass involuntarily the danger must be considered as extreme; a cadaverous smell of the body argues very ill; as well as other indications of what has been called a putrescent tendency, 'a state of body,' says Dr. Gregory, 'the notion of which has in later times been the frequent subject of dispute.' 'That the powers of the living body, in checking the putrescent tendency of all animal matter, should be diminished in certain states of disease does not,' our author very properly remarks, 'appear to be an unreasonable supposition.' The following may be enumerated as the chief symptoms which mark the putrescent diathesis. A loose or very imperfect coagulation of blood; fœtor of the evacuations; a squalid appearance of the skin, and a cadaverous odor of the body; hæmorrhages from the mouth, nose, stomach, rectum, or urethra; the blood being of a very loose texture and quickly putrefying; petechiæ and vibices; a disposition to gangrene in the skin wherever it has been accidentally wounded, or abraded, or exposed to long pressure; the speedy putrefaction of the body after death. 'It would,' Dr. G. continues, 'be necessary to clear up many of the difficulties in which the doctrine of the coagulation of blood is involved before we could arrive at a satisfactory explanation of these phenomena; but, in the mean time, there are sufficient grounds for believing that they depend in a great measure on the deranged functions of the brain. Petechiæ, or tumid spots, appearing on the skin are a very bad omen, inasmuch as with extreme debility they indicate a loose crasis of the blood; this circumstance of petechial eruptions Dr. Cullen makes of sufficient importance to found a species of disease upon; for under the genus typhus the student will see one of the species petechialis spotted fever; the other, icterodes, yellow fever. Petechiæ would seem, for the most part, to be mere accidental indices of extreme weakness connected with morbid activity, and, as above intimated, a loose texture of the blood.

We may add to the above enumeration of unfavorable symptoms a coldness in the breath, which shall be perceived by the hand being placed before the mouth of the individual laboring under fever. Aphthæ, too, about the mouth and fauces, are bad symptoms; they in general mark both extreme weakness and the simultaneous presence of a low inflammatory action about the mucous linings of the first passages.

'The general prognosis in continued fever is certainly favorable. Under proper management a large proportion of cases recover. This is a point which has been made an object of enquiry by different writers, and a very curious coincidence has been traced in the extent of mortality occasioned by continued fever, under circumstances considerably different. The average of deaths in the hospitals of this country appears to be in the ratio of about one to twelve, which is believed to be considerably below the ordinary scale of the mortality of fever, when it occurs in private habitations, even with access to medical assistance. It varies, of course, with the general character of the epidemic, the period of the disease at which it is first submitted to medical treatment, and many other circumstances of nearly equal importance.' A pamphlet was some time since published by a Dr. Brown of Edinburgh (not the celebrated author of the Elementa, to whom reference will be found in another part of the present article), in which it was endeavoured to be proved, that the rate of mortality from fever is the same generally, whatever plan of treatment may be pursued. The object of the writer was to show that no system of remedial management is available in lessening the mortality of the disorder, and that treatment or no treatment amounts in the end, or in the long run, to the same thing. We must refer to the preface of Dr. Young's work on medical literature for a refutation of this position, in which Dr. Y. makes out that the author to whom we have alluded, although ingenious in his arguments, and specious in his inferences, has completely failed in substantiating his assumptions.

341. *Critical days?*—We mark these, says Dr. Uwins, in his Compendium of Medicine, interrogatively, because they are doubtful. One fact, however, appears to be pretty generally admitted, viz. that all fevers are disposed to assume progressively the quotidian, tertian, and quartan type, so that, after the disorder shall have lasted some time, two whole days shall intervene between the terminating tendency, as the 14th, 17th, and 20th. Even here, however, there arises a difficulty, some considering the 21st, others the 20th, the critical day. It is probable that fevers with us are different in respect of crisis from what they were with the ancients. Dr. Gregory says the doctrine of critical days in fever, that is to say the supposition that febrile

diseases are disposed to terminate favorably or unfavorably at certain periods of the disease, more than at others, has found many advocates and some opposers, even from the earliest times. The very general reception which it has met with among mankind makes us unwilling to distrust it altogether; and, if we bear in mind how many circumstances may contribute to disturb the regular course of the disease, we may admit the doctrine of critical days in fever, without much risk of error. There has been some dispute about the precise days, but they are generally set down as the 7th, 9th, 11th, 14th, 17th, and 21st, counting from the invasion of the cold fit. It is seldom that these observations can be verified in the fevers of this country, which run their course with much less regularity than those of warmer climates.

As this doctrine of critical days is thus still a somewhat uncertain, and, at any rate, a disputed point, we shall further extract the remarks on the subject that are found in Dr. Good's Study of Medicine. Dr. G. discusses the question with much ability and candor.

'A sudden and considerable variation of any kind, whether favorable or unfavorable, occurring in the course of the general disease, and producing an influence on its character, is still loosely expressed by the name of crisis. The term is Greek, and pathologically imports a separation, secretion, or excretion of something from the body; which was in truth the meaning ascribed to it when first employed, agreeably to the hypothesis of concoction which has been considered. The original hypothesis is abandoned, but the term is still continued in the sense now offered.

That changes of this kind are perpetually occurring, in the progress of continued fevers, must I think be admitted by every considerate and experienced practitioner. Nothing is more common than to behold a patient suddenly and unexpectedly grow decidedly better or worse in the progress of a fever of almost any kind, and pass on rapidly towards a successful or an unsuccessful termination.

But the important question is, whether there be any particular periods in the progress of a fever in which such changes may be expected? Hippocrates conceived there were; he endeavoured to point out and distinguish them by the name of critical days. Asclepiades and Celsus denied the existence of such periods, and the same diversity of opinion has prevailed in modern times.

It is not very easy to determine upon the subject in the present day, and especially in our own country. For, first, fever like many other complaints may have undergone some change in its progress from a like change in the nature of its remote causes, or in the constitution of man. And next it seems to be generally allowed that sudden transitions, whether regular or irregular, are more apt to take place, in almost all diseases, in warm than in cold climates. On these grounds it is probably a subject that will never become of great practical importance at home. Yet it is well worthy attention as a question of history, and which may yet be of great importance to many parts of the world

If we examine the phenomena of the animal economy, as they occur in a natural series, we shall find that they are almost in every instance governed by a periodical revolution. A man in a state of health and regular habits generally becomes exhausted of sensorial power within a given period of time, and requires a periodical succession of rest; his appetite requires a periodical supply, and his intestines a periodical evacuation. This tendency equally accompanies, and even haunts him in disease; he cannot disengage himself. Gout, rheumatism, mania, rapidly and pertinaciously establish to themselves periods of return. The hæmorrhoidal discharge often does this, and the catamenia constantly. The same occurs in fevers, but especially in intermittents; for the quotidian, the tertian, and the quartan, have upon the whole very exact revolutions. And though accidental circumstances may occasionally produce a considerable influence on every one of these facts, whether morbid or natural, the tendency to a revolutionary course is clear and unquestionable.

Now, although Hippocrates has not appealed to this reasoning, it forms a foundation for his observations; and when stript of the perplexities that encumber his writings on this subject, partly produced by erroneous transcripts, and in a few instances, perhaps, by his own irresistible attachment to the Pythagorean hypothesis of numbers, he may be regarded as laying down the following as critical days of continued fever: the 3d, 5th, 7th, 9th, 11th, 14th, 17th, 20th, beyond which it is not worth while to follow the series, for it is not often that they extend further.

In other parts of his works he regards also the 4th and 6th, and even the 21st, as critical days, so that, in the first week, every day after the disease has fully established itself evinces a disposition to a serious change, in the second week every other day, and in the third week every third day. It is not easy to determine why the 21st day should be a critical day as well as the 20th. Various conjectures have been offered upon the subject; by some it has been regarded as a mistake in the Greek copy, and by others as a piece of favoritism in Hippocrates for this number, in consequence of its being an imperfect one in the Pythagorean philosophy, as the commencement of a septenary.

De Haen, with rigid and patient assiduity, has put Hippocrates to the test upon these data: for he has accurately analysed Hippocrates' own journal of the numerous cases of fever he has most industriously collected and recorded, and finds the positions in most instances to be strictly justified; and that, out of 168 terminations of fever, not less than 107, or more than two-thirds, happened on the days denominated critical, not reckoning the 4th, 6th, or 21st, and that the 4th and 6th were very frequently critical. There are a few anomalies, but it is not necessary to notice them, because they are easily referrible to accidental causes, similar to those that retard or accelerate the paroxysm of intermittent fevers.

Now, admitting the Hippocratic table to be true, the continued fever, in its progress, is mea-

sured by the various types exhibited by intermittent fevers. Thus the quotidian prevails through the first seven days; there is on each day a slight exacerbation, and no one day is more critical than any other. After this period the tertian type commences, and runs through the ensuing week; the principal changes occur on the ninth and eleventh days, and would occur on the thirteenth but that the quartan type now assumes its prerogative; and the principal transitions, after the eleventh, take place on the fourteenth, instead of the thirteenth, the seventeenth, and the twentieth. Dr. Cullen, who has examined this subject with great attention, and simplified it from many of its difficulties, directly asserts that his own experience coincides with the critical days of Hippocrates; and Dr. Fordyce, who scarcely does justice to Cullen in other points, unites with him upon the present, and justly compliments him upon his ingenious examination and explanation of the Greek distribution of critical days. It is nevertheless admitted on all hands, that the order of succession is far less distinct, as well as less regular, in cold than in warm climates; and that it requires a thoroughly attentive and practised eye to notice these changes in our own country, or indeed in any part of northern Europe. And hence Craanen says it is lost time to look for them; Stoll that they are only to be found in inflammatory fevers; and Le Roy that the supposed critical days have no influence, and can lead to no prognosis or peculiarity of practice. Why the first week of a fever should incline to a quotidian type rather than a tertian, or the second to a tertian rather than to a quartan, we know no more than we do why fevers should ever intermit, or at any time observe the distinctions of different types. We are in total ignorance upon all these subjects. We see, moreover, that intermittent fevers, whether quotidian, tertian, or quartan, have their paroxysms recur regularly in the day time; the quotidian in the morning, the tertian at noon, and the quartan in the afternoon; and that in no instance do the paroxysms take place at night; and we see also that in continued fevers the exacerbations uniformly take place later in the day than the paroxysms of the latest intermittent; for these rarely occur earlier than between five and six o'clock in the evening, while the paroxysms in the quartan return commonly before five. Of these interesting and curious scenes we are spectators; but we are nothing more; for we are not admitted to the machinery behind the curtains.

By some pathologists the source of these phenomena is sought for in the influence of the heavenly bodies, and especially in those of the sun and moon. In ancient times these luminaries were supposed to produce an effect on all diseases, and especially on mania, epilepsy, catamenia, and pregnancy. And when the Newtonian philosophy first illuminated mankind with the brilliant doctrine of universal attraction, Dr. Mead stepped forth into the arena and revived and supported the ancient doctrine with great learning and ingenuity. And, as an ingenious conjecture and possible fact, of which no practical use could be made, it was contemplated till towards the close of the last century; about which time Dr. Darwin, by interweaving it with his new hypothesis, once more endeavoured to raise it into popular notice, and give it an air of serious importance. Dr. Balfour of British India, however, has still more lately brought it forward as a doctrine capable of direct proof, and as peculiarly affecting the progress of fevers. His opinion, which he endeavours to support by weighty facts and arguments, is, that the influence of the sun and the moon, when in a state of conjunction which is named sol-lunar influence, produces paroxysms or exacerbations in continued fever, in all cases in which a paroxysmal diathesis (for such is his expression) exists; and as this influence declines, in consequence of the gradual separation of these luminaries from each other, and their getting into a state of opposition, a way is left open to the system for a critical and beneficial change, which is sure to take place, provided the critical disposition is at this time matured. In other words, paroxysms and exacerbations in fever may be expected to take place (and do in fact take place) at spring tides, and crises at neap tides.

This is a new view of the influence of the heavenly bodies upon the human frame, and a view which, though feebly supported by facts, is advanced with all the dogmatism of an established science. There is nevertheless more in medical astrology than is perhaps generally supposed; it is an important branch of meteorology, and, as such, is well worth studying. Nor can there, I think, be a question in any impartial mind, that, under certain circumstances, and especially in tropical climates, many diseases are influenced by lunation, as we are sure they are in all climates by insolation. The concurrent observation of a host of candid and attentive pathologists, who have been witnesses of what they relate, are sufficient to impress us with this belief; but, till we know more fully what these circumstances are, we cannot avail ourselves of their remarks, and can only treasure them up as so many isolated facts. And hence it is that in no age or country whatever has the study been turned to any practical advantage, expedited the cure of a disease, or enabled us to transform the type or interval of one kind of fever into that of another. Nor is it any exclusive reproach to the art of medicine that it should be so; for, of all the subdivisions of general philosophy, there is none so little entitled to the name of a science as meteorology itself. And, till the naturalist has explained the variations of the barometer, the physician need not blush at being incapable of turning to account the supposed influence of the planets, or of unfolding the origin, or tracing the capricious courses, of epidemics and pestilences.'

342. *Treatment of continued fevers.*—In considering the treatment of fever we may state that three indications present themselves.

Indication 1st. To excite such an action in the system as that the febrile concatenations shall be broken in upon before they may have had time to become confirmed into a habit; in other words, and according to the expression of some authors, to cut short the disease. Whether we

are able to effect this purpose at any time, and in any way, has been considered by some more than doubtful; but there should seem sufficient evidence for the great probability, at least, in some instances, of the interference of art in a forcible way, and by modes immediately to be mentioned, being available to the fulfilment of the indication proposed, provided the attempt be made sufficiently early; it would appear however as certain that fever is not properly cured in any other way, and that, should we fail of thus early crushing the nascent malady, we must be contented afterwards to follow the second and the third indication.

Indication the 2nd, being to moderate excitement, and diminish heat; to subdue inflammatory incidents, equalize the circulation, and open the secretions.

Indication the 3d.—To keep watch, as it were, over the powers of the system, and, in cases of more than ordinary sinking, to sustain the falling powers. Dr. Cullen has been ridiculed for talking of obviating the tendency of death, inasmuch it is said as all remedial agency, at all times, and under all circumstances, resolves itself into this principle; but in a disorder open to such constant changes, and incidental occurrences, as fever, there is an especial propriety in recognising the necessity of constant vigilance upon the ground now alluded to.

The first indication, viz. that of cutting short fever, has been proposed to be accomplished by large blood lettings; by dashing cold water over the naked body of the patient; by administering emetics; by drastic purgatives; or by mental impulse or agitation. When the fever is of an inflammatory type, with what in Brown's language would be called a sthenic diathesis, considerable detractions of blood at the commencement of fever, that is during the fulness of heat and excitement, will often be found of very essential service in moderating its violence, if not of strangling its birth. This practice cannot however be adopted with safety in all kinds of fevers, and even in some where the measure of excitement or irritation would seem to warrant the practice, the constitution of the air, or some exterior or interior circumstance, may render the expedient dangerous; and we should recollect, that if we go beyond the right point of reduction, without succeeding in crushing the malady, we may induce a weakness which will tend to make the patient less capable of grappling with the subsequent disorder. We may be told, perhaps, that the weak often get through fever under which the strong and robust give way; but, even allowing there may be some truth in this position, and some rectitude in the inference which may be drawn from it favorable to depleting and debilitating measures, we ought ever to recollect that natural feebleness, and that brought on by artificial means, are very different, and that it always behoves the physician to be careful, while he is destroying the complaint, not at the same time to destroy the subject of the complaint.

In the fevers of tropical climates the vi et armis plan of treatment is often imperiously, and at all hazards demanded, but for the most part disorders with us do not take on ab origine such a formidable aspect, neither do they demand or admit of such forcibly opposing measures; for ourselves then we should hesitate in the general way about joining in the recommendation of very large detractions of blood in the onset of fever, by way of laying the patient prostrate, and crushing the nascent malady; at the same time it has seemed to us that small blood-letting, say to the amount of ten or twelve ounces, in the onset of a fever which is marked by much arterial excitement and tendency to topical disorder, does considerable good by checking this tendency, and by keeping the malady from mounting up to a malignant height.

With respect to the second measure above mentioned, of cutting short the progress of continued fever, viz. that of dashing cold water on the surface of the body, we are also somewhat doubtful as to its efficacy in this point of view; but we are convinced that it may be made very serviceable in mitigating the force of the disorder, and assisting to conduct the patient through its course. We shall immediately speak of this practice more in detail when upon the subject of the second indication of remedial treatment.

The exciting cause of some fevers, when the predisposition is considerable, may have been taking into the stomach some material which either by its quantity or quality has thus proved deleterious. In this case, especially, emetics would appear to be indicated as arresting remedies, and the course of fever may occasionally be stopped both by the administration of them and of the more drastic kind of purgatives; such particularly as elaterium, which, besides procuring intestinal evacuations, so influences the whole frame as to counteract the febrile tendency. When emetics are employed with this view, viz. that of cutting short fever, they should consist in the general way of ipecacuan and anatomy combined, since this combination has a tendency to promote the secretions of the surface and thus to equalise the circulation.

℞ Pulveris ipecacuanhæ ℈j.
Antimonii tartarizati gr. i.
Fiat pulv. emeticus.

Take a scruple of ipecacuan powder and a grain of tartarised antimony (tartar emetic); mix them for an emetic powder.

℞ Vini ipecacuanhæ f. ʒij.
Antimonii tartarizati gr. i.
Aquæ puræ ʒx.
Fiat haustus emeticus.

Take two fluid drachms of ipecacuan wine, one grain of tartarised antimony, and ten fluid drachms of water; mix them for an emetic draught.

The elaterium may be given in the dose of one grain, and in the form of pill, either made up with a little aromatic confection or crumb of bread: or five grains of calomel, with fifteen of compound scammony powder, may be administered as a drastic purgative, or any other of the resinous and active cathartics; for from this the resinous class of medicines should the purgatives be now chosen, while when the fever has established itself, and you are desirous of combining

the agency of refrigerating medicinal with that of aperients, the saline purgatives are for the most part to be preferred.

Indication 2nd. Blood-letting, cold effusion; or ablution, purgatives, diaphoretics, diuretics, and refrigerants, are (says an author whom we profess a good deal to follow in the present disquisition), now resorted to upon different principles, and are to be employed with more or less freedom and frequency, as the excitement and heat are high, the powers vigorous, and the tendency to local inflammation or congestion great. When topical affections are urgent, at the same time that the vital powers are low, leeches and cupping near the affected part are to be preferred to general bleeding. It ought, however, always to be recollected, that it is rather smothered or obstructed strength that we have to deal with in fever, than actual or positive debility; and that the moderate use of the lancet, in cases calling for its employment, may for the most part be resorted to in the early stages of the disease without fear of consequences; some fevers, however, will be found not to bear bleeding, even though excitement and power seem considerable; and authors in their directions respecting venæsections are too apt to overlook very frequent exceptions to general rules. Endemic and epidemic peculiarities ought always to be carefully appreciated by the physician. For months together at times, and without any external circumstances to explain the reason, fevers demand a different treatment from what may be ordinarily pursued, or the patient will fall a victim to the practitioner's systematic obstinacy.

Cold affusion, or ablution also of the skin, will be found as above intimated to favor the fulfilment of the second indication, of moderating excitement and heat, and conducing to a healthy and equable discharge from the surface of the body. The following regulations and restrictions respecting this practice we copy from the elegant volumes of the late Dr. Currie.

Whoever, says this author, has watched the progress of fever must have observed the justness of the observation made by Cullen, Vogel, De Haen and others, that even those genera which are denominated continued are not strictly such, but have pretty regular and distinct exacerbations and remissions in each diurnal period. In this space of time Dr. Cullen contends that an attentive observer may commonly distinguish two separate paroxysms. My observations do not enable me to confirm his position in its full extent, but one exacerbation and one remission in the twenty-four hours seem generally observable. The exacerbation usually occurs in the afternoon or evening, the remission towards morning. These exacerbations are marked by increased flushing, thirst, and restlessness. If the heat of the patient be at such times taken by the thermometer, it will be found to have risen one or two degrees in the central parts of the body above the average heat of fever, and still more in the extremities. The safest and most advantageous time for using the aspersion or affusion of cold water is when the exacerbation is at its height, or immediately after its declination is begun; and this has led me almost always to direct it to be employed from six to nine in the evening; but it may be safely used at any time of the day, when there is no sense of chilness present, when the heat of the surface is steadily above what is natural, and when there is no general or profuse sensible perspiration. These particulars are of the utmost importance.

1. If the affusion of cold water on the surface of the body be used during the cold stage of the paroxysm of fever, the respiration is nearly suspended; the pulse becomes fluttering, feeble, and of incalculable frequency; the surface and extremities become doubly cold and shrivelled; and the patient seems to struggle with the pangs of instant dissolution.

2. Neither ought it to be used when the heat measured by the thermometer is less than, or even only equal to, the natural heat, though the patient should feel no degree of chilness. This is sometimes the case towards the last stages of fever, when the powers of life are too weak to sustain so powerful a stimulus.

3. It is necessary to abstain from the use of this remedy when the body is under profuse sensible perspiration; and this caution is more important in proportion to the continuance of this perspiration. In the commencement of sweating, especially if it has been brought on by violent exercise, the affusion of cold water on the naked body, or even immersion in the cold bath, may be hazarded with little risk, and sometimes may be resorted to with great benefit. After sweating has continued some time and flowed freely, especially if the body has remained at rest, either the affusion or immersion is attended with danger, even though the heat of the body at the moment of using it be greater than natural. Sweating is always a cooling process in itself, but in bed it is often prolonged by artificial means, and the body is prevented from cooling under it to the natural degree, by the load of bed clothes. When the heat has been thus artificially kept up, a practitioner, judging by the information of his thermometer only, may be led into error. In this situation, however, the heat sinks rapidly on the exposure of the surface of the body even to the external air, and the application of cold water either by affusion or immersion is accompanied by a loss of heat and a deficiency of re-action, which are altogether inconsistent with safety.

Under these restrictions, says Dr. C., the cold affusion may be used at any period of fever; but its effects will be more salutary in proportion as it is used more early. When employed in the advanced stages of fever, where the heat is reduced and debility great, some cordial should be given immediately after it, and the best is warm wine. The general effect of the cold affusion, says Dr. Currie, in continuance will be more clearly illustrated by the following cases. They are a selection from a great number, the records of which have been preserved, and which lead to the same results. They are so arranged as to exhibit the salutary effects of this remedy in the different stages of fever, and illustrate the precautions laid down against using it improperly.

The first cases which Dr. Currie selects are those in which the affusion produced, according to his account, a complete solution of the fever; but in these cases the remedy was had recourse to before the fourth day; after that day, indeed for the most part after the third, the affusion does not, according to our author, usually produce an immediate solution of the disease, but it instantly abates it, and by a few repetitions brings it to a happy termination in two or three days.

As these cases of the late trial of the affusion are more appropriate to the present division of our subject we shall select one or two of the most striking of them, and leave the reader to make his own application.

A young lady of nineteen, in the seventh or eighth day of a typhus became my patient, September 26th, 1794. Her pulse was 112 and feeble, heat 101°. She had great pain in the head and much prostration of strength; her eyes were suffused and dull; her tongue furred; her spirits greatly depressed. Saline medicines were used for this patient, with lemonade for her usual drink, and moderate quantities of wine were given mixed with water. The burning sensation, in the palms of her hands and temples, was assuaged by frequent sponging with vinegar, and every evening at six P. M. three or four gallons of cold brine were thrown over her. The happy effects so frequently described were in this case particularly striking. The pulse fell almost immediately to 90, the heat to its natural standard, and the head ache vanished; a gentle diaphoresis followed with easy sleep; in a few hours, however, the feverish symptoms returned, and towards the hour of six in the evening the fever was in its highest state of exacerbation. At this hour, therefore, the affusion was repeated with the same happy effects; though the fever returned as before it was in a milder form; the same practice was continued, and on the 2nd of October she was entirely free from the disease.

The following is a case in which the cold affusion was employed in the more advanced periods of fever. It is related, we are told, circumstantially, because it contains the particulars of the narrator's practice in the epidemic, in which it occurred. In such instances, says our author, as might be expected, it does not procure the same advantages as in the earlier stages, when the strength is less impaired, and the morbid actions less firmly associated; nevertheless it is evidently advantageous, while the heat of the patient exceeds the natural standard, though it ought to be employed with caution in the more advanced stages of the disease, and in such cases, according to my later experience, of a temperature from 15° to 20° degrees only, below the human heat. In the greater part of the cases which Dr. C. recites the water employed was the pump water of the hospital, saturated with sea salt, and of a temperature from 40° to 50° of Fahrenheit.

F. G. a soldier of the thirtieth regiment, aged thirty-three, fell under my care on the 9th of June, 1792, during the prevalence of the epidemic in the regiment. He was in the ninth day of the disease. His pulse 100 and feeble; his heat 104°: his thirst was very great; his tongue foul and black; frequent cough occurred, with streaks of blood in the expectoration; and petichiæ appeared all over his body. His mind was at all times confused, and at times he was completely delirious. I directed that his strength should be supported by administering a bottle of wine every day with an equal quantity of gruel; that every night he should take an opiate draught; and that a complete operation of his bowels should be procured by a clyster administered daily, and, if this did not succeed, by a few grains of calomel. I also directed that a bucket full of salt water should be thrown over him immediately and repeated according to circumstances. In a few minutes after the affusion, the heat was 98°, the pulse 98, and his mind more calm and collected; two hours afterwards he had relapsed into nearly his former state, but the night was passed more tranquilly. The whole of this practice was continued with nearly the same result till the twelfth day of the disease, the affusion having always been performed in the evening, and sometimes at noon also. The fever continued its usual period; but on the twelfth day, the heat having sunk to its natural standard, the cold affusion was thenceforth omitted: we, however, sponged the whole body once or twice a day with vinegar. The patient was in a state of convalescence on the eighteenth day from the first attack.

Partly upon the same principles which regulated the above practice of employing cold water to the surface with a view to the abating of irritation, it is the practice of many, especially at the time in which we are now writing, to institute small and repeated bleedings, and in some cases this practice will be found very beneficial; it has lately obtained, partly on account of the prevalent notion of fever being necessarily connected with local inflammation; and although the doctrine may not be altogether stable, for fever seems capable of a full development and establishment without the presence of topical disorder, there is, it must be admitted, a tendency to such local manifestation in most distempers of the febrile class; and the plan of depleting in a moderate way, keeps as it were this tendency under, and may be considered as rather adding to, than subtracting from, the general energies of the system by equalising the circulating impetus. From four to six ounces may be taken according to circumstances, and at any time almost during the course of the fever, excepting when the tendency to sinking is marked and extreme.

Purgatives are almost invariably called for in all kinds and in most stages of fever. To keep the alimentary and intestinal canal free is one of the most important principles in conducting fevers to a favorable termination. When visceral obstructions are present, mercurial preparations may precede and alternate with saline and other purgatives; but the continued fevers which are met with in this country do not for the most part require very large and repeated doses of calomel.

Diaphoretics, especially those of the saline and cooling kind, are valuable medicines in fever; and it may be questioned whether anti-

mony which was at one time in more than due estimation is not now too little appreciated; like the cold affusion and ablution, and like small and judicious bleedings, antimony properly managed may be made to keep up a constant and regular action upon the excretories of the surface, and thus moderate re-acting violence, and assist in equalising the circulation.

Diuretics, likewise, of the saline and cooling order are occasionally administered in fever with much advantage. We do not now talk of concoction in the urine, nor do we direct our remedial measures towards effecting changes in the quality of this excretion; but it is of practical importance to recollect that conspicuous changes in the urine invariably attend changes in the disorder's aspect and character.

Refrigerants are obviously called for when heat is above the natural standard; indeed cold affusion and diaphoretics may by other terms be named refrigerants; however, the modus agendi of internal refrigerants is often attended with some difficulty in the explanation. That a little nitre dissolved in water should speedily bring down the heat of the whole body, some degrees, is not very easy to account for: the fact however would of itself be sufficient to show, that, as intimated in the preliminary discourse, much remains to be learned on the subject both of natural and morbid temperature, before pathology can congratulate itself on much accuracy of knowledge or precision of notion in reference to these particulars.

Formulæ for purgatives, diaphoretics, diuretics, and refrigerants, taken from Dr. Gregory and Dr. Uwins.

Purgatives.

℞ Pulveris jalapæ grana viginti.
Hydrarg. submuriatis grana quatuor.
Misce: fiat pulvis.

Take of powdered jalap a scruple, of calomel four grains. Make them into a powder.

℞ Magnesiæ sulphatis ʒvj.
Liquoris ammoniæ acetatis f. ℥ß
Syrupi simplicis f. ʒij.
Aquæ puræ f. ʒx.
Fiat haustus.

Take of Epsom salts six drachms, liquor of acetate of ammonia a fluid half ounce, simple syrup two fluid drachms, water ten fluid drachms. Make them into a draught.

℞ Potassæ tartratis ʒiß.
Syrupi aurantiorum f. ʒij.
Infusi sennæ f. ℥iß.
Fiat haustus.

Take of tartrate of potass one drachm and a half, syrup of orange peel two fluid drachms, infusion of senna a fluid ounce and a half. Make them into a draught.

℞ Pulveris jalapæ grs. xv.
Sodæ sulphatis ʒiij.
Fiat pulvis.

Take of powder of jalap fifteen grains, sulphur of soda three drachms. Make them into a powder.

Diaphoretics.

℞ Antimonii tartarizati gr. j.
Syrupi papaveris f. ℥iß.
Aquæ puræ f. ℥iiß.
Fiat mixtura. Dosis pars quarta.

Take of tartarised antimony one grain, syrup of white poppy a fluid ounce and a half, water two fluid ounces and a half. Make them into a mixture. Dose a fourth part.

℞ Liquoris ammoniæ acetatis f. ʒiij.
Vini antimonii tartarizati f. ʒj.
Syrupi papaveris f. ʒij.
Aquæ puræ f. ʒx.
Fiat haustus.

Take of liquor of acetated ammonia three fluid drachms, wine of tartarised antimony one fluid drachm, syrup of white poppies two fluid drachms, water ten fluid drachms. Make them into a draught.

Diuretics.

℞ Potassæ nitratis grana quinque.
Aquæ menthæ pulegii drachmas quatuor
Liquor. antim. tartariz. guttas quinque.
Tincti. digitalis guttas quinque.
Syrupi drachmam.
Misce: fiat haustus.

Take of nitre five grains, four fluid drachms of pennyroyal water, liquor of tartarised antimony five drops, tincture of digitalis five drops, syrup a fluid drachm. Mix into a draught.

℞ Potassæ nitratis ℈ß.
Spiritus ætheris nitrici f. ʒj.
Misturæ camphoræ f. ℥iß.
Syrupi simplicis f. ʒj.
Fiat haustus.

Take of nitre half a scruple, spirit of nitric ether a fluid drachm, camphor mixture a fluid ounce and a half, simple syrup a fluid drachm. Mix for a draught.

℞ Potassæ acetatis ʒj.
Syrupi simplicis f. ʒij.
Aquæ puræ f. ℥iß.
Fiat haustus.

Take of acetate of potass a drachm, simple syrup two fluid drachms, water a fluid ounce and a half. Make them into a draught.

Refrigerants.

℞ Potassæ nitratis ℈ß.
Syrupi simplicis f. ʒij.
Aquæ puræ f. ℥iß.
Fiat haustus.

Take of nitre half a scruple, simple syrup two fluid drachms, water ten fluid drachms. Make them into a draught.

℞ Potassæ supertartratis ʒvj.
Sacchari purificati ℥iv.
Corticis aurantiorum ℥ß.
Aquæ ferventis o.iij.
Misceantur pro potu.

Take of cream of tartar six drachms, purified sugar four ounces, orange peel half an ounce, hot water three pints (imperial). Mix for a drink. For the mode of making the saline

draught to be drunk in a state of effervescence, see under the head of intermittent fever.

Indication 3. When obviously marked debility prevails, stimulants and cordials appear to be called for. It will be found, however, that these artificial excitants are much less admissible in febrile weakness and sinking than would, à priori, be imagined. Some systematists have gone so far as to forbid altogether the employment of stimuli in fever, while others have pushed them through thick and thin without regard to any other considerations than the prevailing lowness of the vital energies. Both extremes are wrong.

The propriety of stimuli seems questionable, while any of the secretions or excretions are in a manner locked up; especially when the bowels are constipated, the stomach laden, and the surface of the body in a dry unperspirable state; when the pulse too is sharp, as it is expressed, that is wanting in softness and fulness, then we must be careful how we meet the weakness with exciting agents. But when the patient lies prostrate under the pressure of typhoid lowness, the bowels being loose, the skin open, and the tongue disposed to moisture, we should be losing ground by withholding supporting powers. Under these circumstances, too, opium will meet and subdue the restlessness of fever, without being attended by any injurious consequences. Dr. Currie's rule, in respect to the time and circumstances of opium's admission, will be found of importance to recollect; it may be given, he says, when the stomach is empty of food, the bowels loose, and the skin moist; and, as above intimated, these are conditions generally for the admission of the excitantia in fever; one of the most beneficial and least objectionable of which is the subcarbonate of ammonia.

℞ Ammoniæ subcarbonatis ℈ß.
Confectionis aromaticæ ℈j.
Aquæ puræ f. ℥iß.
Fiat haustus.

Take of sub-carbonate of ammonia half a scruple, aromatic confection one scruple, water a fluid ounce and a half. Make them into a draught.

℞ Liquoris ammoniæ acetatis f. ʒiij.
Ammoniæ subcarbonatis gr. vi.
Misturæ camphoræ f. ℥iß.
Fiat haustus.

Take of liquor of acetate of ammonia three fluid drachms, sub-carbonate of ammonia six grains, camphorated mixture a fluid ounce and a half. Make them into a draught.

℞ Tincturæ opii m. xv.
Succi lemonum f. ℥ß.
Aquæ puræ f. ℥iß.
Fiat haustus.

Take of tincture of opium fifteen minims, lemon juice half a fluid ounce, water a fluid ounce and a half. Make a draught.

The black drop may often be employed with advantage where opium is required, but seems of doubtful admissibility. One drop of this last is equal to four or five of the tinctura opii. The liquor opii sedativus of Battley is also useful in being without some of the deleterious qualities of the common tincture. The dose of Battley's liquor is from fifteen to thirty drops.

When what are called putrescent symptoms make their appearance, the mineral acids will be found occasionally of abundant service; some practitioners trust almost entirely to the use of these in those kinds of fevers which tend towards the typhus gravior of authors.

℞ Acidi muriatici,
Acidi nitrici ā ā. m. ij.
Syrupi simplicis f. ℥ß.
Aquæ puræ ℥iß.
Fiat haustus.

Take of muriatic acid and nitric acid of each two minims, simple syrup half a fluid ounce, water a fluid ounce and a half. Make them into a draught.

℞ Acidi nitrici diluti f. ʒij.
Syrupi aurantiorum f. ℥ij.
Aquæ puræ f. ℥x.
Misce pro potu communi.

Take of diluted nitric acid two fluid drachms, syrup of orange peel two fluid ounces, water ten fluid ounces. Mix them for a common drink.

℞ Acidi sulphurici diluti m. xij.
Decocti cinchonæ f. ℥iß.
Syrupi papaveris, f. ʒij.
Fiat haustus.

Take of diluted sulphuric acid twelve minims, decoction of bark a fluid ounce and a half, syrup of white poppy two fluid drachms. Make a draught.

Cascarilla, valerian, serpentaria, camphora, and the æthers are in use, when the fever exhibits the typhus mitior or nervous, rather than the typhus gravior, or, as it would be said by some, putrid aspect. It is necessary to observe that, when camphor is administered with any other intention than that of a mere adjunct to other medicines, the dose ought to be much larger than can be given in the mixtura camphoræ of the pharmacopœia. It should be exhibited in doses from six to ten grains, either rubbed down with mucilage of acacia, or in the form of bolus. Hyoscyamus is a useful medicine in nervous fever, when sleep is required, and opium is forbidden.

℞ Tincturæ hyoscyami, f. ʒß.
Camphoræ, gr. vi.
Mucilag. acaciæ, f. ʒi.
Spiritus ætheris nitrici, f. ʒi.
Syrupi simplicis ʒi.
Aquæ puræ, f. ℥i.
Fiat haustus.

Take of tincture of henbane half a fluid drachm, camphor six grains, acacia mucilage a fluid drachm, spirit of nitric ether a fluid drachm, simple syrup a fluid drachm, water a fluid ounce. Make them into a draught.

In colliquative diarrhœa, the opiate confection will be found an efficacious medicine.

℞ Confectionis opii grs. xv.
Aquæ cinnamomi f. ℥iß.
Fiat haustus.

Take of opiate confection fifteen grains, cinna-

mon water a fluid ounce and a half. Make a draught.

But the young practitioner must always be careful not to interfere too much with nature's operations by precipitately checking an evacuation, which, if it takes place while the powers of the system are yet vigorous, and is not exhaustingly profuse, may be looked upon as salutary rather than injurious, and ought to be assisted by slight and mild mercurials; as with five grains of the pilula hydrargyri, or one grain of calomel, rather than immediately suppressed by opium and astringents.

Should hæmorrhage take place from the bowels, a considerable dose of tincture of opium, from thirty to forty minims, may be resorted to with much promise of advantage, and the Peruvian bark with sulphuric acid, and syrup of white poppy be afterwards employed according to the extent of sinking manifestation; but, even in these cases, we must be on our guard against too much of astringent agency.

Of the external applications that are made use of occasionally in the management of fever very little need be said. In cases of much cerebral disturbance, leeches are often demanded for the temples; and it occasionally becomes expedient to have the head shaved, and to keep the naked scalp constantly wetted with an evaporating lotion.

℞ Liquoris ammoniæ acetatis f. ℥vij.
Spiritus ætheris sulphurici f. ℥j.
Fiat lotio.

Take of liquor of acetated ammonia seven fluid ounces, spirit of sulphuric ether one fluid ounce. Make a lotion.

℞ Ammoniæ muriatis ʒiß.
Aquæ puræ f. ℥viß.
Spiritus rectificati f. ℥iß.
Fiat lotio.

Take of muriate of ammonia (sal ammoniac) a drachm and a half, water six fluid ounces and a half, rectified spirit a fluid ounce and a half. Mix them for a lotion.

Some practitioners are accustomed to apply blisters to the scalp in the event of cerebral affection proving urgent. This appears to be a questionable practice. Blisters ought rather to be applied to the nucha, or legs, and not to the head; and where the vascular irritation is so high as to call for either topical or general blood letting, this ought always to be premised, and the blisters not had recourse to till after the vessels have been emptied.

Whether convalescence from fever should be treated by tonics, especially by Peruvian bark, has been made a question in modern times; indeed, it is the more common custom in the present day to leave the confirmation of health and strength entirely to time and nature. We find, however, that relapses from fever are by no means infrequent; and it may be that the departure from the 'throwing in bark' practice has been too freely and fearlessly carried to the extent of throwing it entirely aside. It is probable, at least, that a little tonic operation upon the nervous and vascular organisation of an individual recovering from a protracted disorder may obviate the tendency to the recurrence of those actions by which the disorder was constituted. The sulphate of quinine seems well adapted to the circumstance of convalescence, as it is powerful without being bulky and nauseating.'

Recapitulation of the treatment in continued fever.

1. To endeavour to cut it short, either by the administration of an emetic, of a violent or drastic purgative, or by blood-letting to a pretty considerable amount, or by dashing cold water over the naked body.

2. To endeavour at conducting it to a safe termination, or assist in expediting such termination by moderate blood-lettings at any time of the fever's course that heat and irritation seem to demand it, to wash or sponge the body with cold water during the existence of dry heat, or to dash cold water over the body in the way of affusion, to administer saline purgatives, or diaphoretics, or diuretics, or refrigerants; and in cases of decidedly marked topical affection to apply leeches or cold evaporating lotions over the parts affected; and when there are indications of visceral disorder, especially of the liver, to give calomel or blue pill in combination with the purgative medicines.

3. To support the powers of life when they appear sinking under the violence of the commotion, by ammonia, wine and cordials, always recollecting that these kinds of stimuli are then most admissible when the skin is in an open state, and the pulse free from constricted sharpness; to administer opium and wine when diarrhœa or hæmorrhage from the bowels are urgent, still acting under the impression that care must be taken not to check precipitately those discharges which seem manifestations of nature's efforts to procure a solution of the disease; to administer those vegetable tonics which are more especially adapted to nervous weakness, when the malady seems as it were to fix upon the nerves, rather than tend to typhus gravior; these tonics are valerian, serpentaria, &c.; to allay irritation by vegetable narcotics, such as henbane, when opium is inadmissible; and lastly to assist convalescence by the moderate use of bark in one or other of its forms.

343. *Means of prevention?*—Before concluding the subject of general fevers, it will be expected that we introduce a few remarks on the means of prevention: of which, by the way, much more has been said than the facts of the case have warranted; separation and free ventilation being after all the most efficacious means of obviating the communication of the malady. It should seem that the poison of whatever nature and kind it may be, is received into the system through the medium of the lungs; for while the skin is whole or unabraded, that is while the cuticle or scarf skin properly covers the cutis vera or true skin, the poison of contagion cannot make its way into the system. Merely lay the most virulent miasm upon the outer skin of an individual, say the small pox virus, or even the virus which produces hydrophobia, and no harm will be done. For the body to be infected, it is necessary that a puncture or abrasion be made of this outer surface, so as that the matter infecting shall

get to the blood vessels, or nerves, or absorbents. Experiments, moreover, have been made, which are at variance with the notion that might be entertained of the stomach being an inlet to these infecting materials, or that the individual swallows the poisons which produce their specific effects. Dr. Rush, of Philadelphia, caused a negro girl to swallow some small-pox matter, and it was done without producing the disease; so that in point of fact all that is to be feared, or at any rate the most that is to be apprehended, is taking into the lungs by inspiration the matter immediately emitted from the lungs of another; or the matter exuded by the sick, whether immediately exhaling from his body or having been collected and concentrated in some material with which his body has been in contact. These simple facts being admitted, it necessarily follows that, as above stated, plenty of washing so as to prevent the collection and concentration of the materies morbi, and a plentiful supply of fresh air, so as to prevent as much as possible a poisonous atmosphere, are the main particulars of preventive measures. It is questionable whether the aromatics and perfumes that have been had recourse to under the notion of disinfection or preservation may not be sometimes worse than useless, excepting as they may bring with them a confidence of their efficacy; for a careless and confident state of mind with regard to infection would seem occasionally some sort of guarantee against its influence.

We may not, perhaps, assume that this is the explanation of the comparative immunity of medical attendants and nurses, more especially of the latter; for these seem to be guarded in some measure by a law which obtains in reference to a contagious atmosphere, viz. that those who are constantly inhaling it are much less obnoxious to its poisonous influence than those who are only partially and occasionally exposed.

'As a matter of prevention,' says Dr. Thomas, in his very comprehensive and useful work entitled The Modern Practice of Physic, 'strict non-intercourse with the sick should be enforced, and those whose duty or kindness leads them to visit the patient, should be very careful not to inhale his breath, or expose themselves to that steam of perspirable matter which emanates from his body when the bed clothes are turned down for the purpose of rendering him any offices of assistance. While engaged in such duties they should retain their breath for a time; and, if under the unavoidable necessity of inhaling the tainted atmosphere, they should, as soon afterwards as possible, blow from the nose, spit, or wash their mouth, with a view of detaching any infectious particles that may have adhered to these passages. All the discharges of the patient should be thrown away to some distance as soon as they are rendered, and the vessel washed with boiling water. But the most important precaution of all is to maintain a perpetual circulation of air in the patient's chamber throughout the whole course of the disease; and for this purpose a part of the window should be left open both at top and bottom, and the opposite window where there is one, or else the door of the room, should also be a little opened. For the better success of ventilation the bed curtains should never be drawn close round the patient but merely one of them let down to screen him from the irritation of light. When open windows cannot be had recourse to on account of high winds, or other inclemency of the weather, a small fire must be kindled in the grate, so as to cause a current and frequent removal of air in the chamber without considerably raising the temperature. Another essential precaution consists in frequently changing the body and bed linen of the patient, which, as soon as removed and carried away, may be put into a tub and covered over with water, into which a handful of lime or potash may be thrown, for the purpose of detaching the animal matters with which they may be impregnated. In few words,' he adds, 'unremitting regard to ventilation, and the strictest attention to cleanliness in all its parts, constitute the whole secret of evading contagion. Fumigations with nitric or muriatic acid in a state of vapor may however be employed as auxiliaries.'

We shall extract the brief history and account that this minute and practical author, Dr. Thomas, gives of the practice of fumigation as a preventive and counteractive of febrile contagion.

Nitric acid has been used by Dr. Carmichael Smyth as a fumigation, with the greatest success, in malignant fever. In the year 1780 the disease broke out among the Spanish prisoners confined in Winchester Castle: he embraced the opportunity of giving the remedy a fair trial, and obtained the most decisive evidence of its happy power in preventing the spreading or farther communication of the infection. He found he could use it without risk or inconvenience to respiration, and therefore thought it the most proper antidote to be applied where persons are unavoidably obliged to be present.

The doctor's mode of obtaining nitric acid is by decomposing nitre by means of heated sulphuric acid, which may be done as follows: Put half an ounce of this acid into a crucible, glass, china cup, or saucer, and warm this over a lamp, or in heated sand, adding to it from time to time some nitre; these vessels he directs to be placed at twenty or thirty feet distance from each other, according to the height of the ceiling, and virulence of the contagion. In hospitals and prisons he advises the lamps, or vessels containing heated sand, to be placed on the floor; but on board of ships he recommends to hang them to the beams by waxed silk cords.

From the well known efficacy of the sulphuric acid, in destroying contagion, he advises it to be employed as a fumigation for clothes and furniture, &c.: but for purifying empty prisons, hospitals, wards, and ships, he gives the preference to the nitric, its vapors being more volatile and penetrating, and not having the disagreeable smell which the sulphuric has, and thinking it at the same time equally efficacious.

Monsieur Guyton Morveau, in his treatise on The Means of Purifying Infected Air, claims the merit of being the discoverer of the power of the mineral acids to destroy contagion, and endeavours to establish the superiority of the muriatic acid over all others. Upon a full investigation of the matter it appears, however, that the power

of the mineral acids to destroy contagion was know to Sir John Pringle as early as the year 1750; and their utility for that purpose was mentioned by Dr. Johnson in his pamphlet published in 1758, in which we are told that the vapor of muriatic acid was successfully employed by him in correcting the contagion of a very malignant fever, which had raged at Kidderminster two years before that period.

Dr. Smyth has also claimed the having been the first who used the mineral acid gas in the apartments of the sick, and has alleged that they never had been employed by Dr. Johnson but in places where no one was present, or where the sick were removed. This opinion has been refuted by Dr. Johnson's son, and the invention of his father most incontestably established. What Dr. Smyth seems therefore entitled to is the merit of having brought the discovery into public notice, and of having applied and extended it to general use.

It seems of little consequence whether we employ the nitric acid or the muriatic, in the form of gas for the purpose of destroying contagion, and purifying infected air, as the powers of both are extensive and certain. The muriatic is, however, thought to be more diffusible than the other. When we give it the preference it may be used in the following manner:—Put one pound of common salt into an earthen vessel, and pour over it from time to time a small quantity of sulphuric acid, till the whole salt is moistened. If the air is foul, and peculiarly offensive, apply a gentle heat under the vessel to extract a large quantity of vapor: but in general the simple addition of the acid to the salt will be found sufficient, unless the apartment is very large.

The most effectual, however, of all fumigations is perhaps the following; but it requires some nicety:—Take of manganese, in powder, two parts, the same of common salt, of sulphuric acid three parts, and of water one part. Put an ounce of the mixed manganese and salt into a basin; add of water a large tea spoonful, then drop in half a tea spoonful of sulphuric acid, and repeat this till you have used a tea spoonful and a half of the acid. In this manner keep up a sensible extrication of the fumes.

On the appearance of typhus, or any infectious disorder, in a gaol, hospital, workhouse, garrison, transport ship, or any other place where many persons are crowded together, we should not fail to advise one of these gaseous fumigations in every room, in addition to a free ventilation and the greatest cleanliness. The same steps should be adopted in academies, boarding-schools, and even our dwelling-houses.

The principal objections against these acid fumigations are, that they occasionally oppress the breathing of individuals whose respiratory functions are already perhaps morbidly affected, and that they tarnish the furniture of the rooms, at least the metallic part of such furniture. More recently still the chloruret of oxide of sodium, and the chloruret of the oxide of calcium, have been substituted for the fumigation above alluded to. Waters, impregnated with these chlorurets, are aspersed about the apartments, and are alleged to possess to the full the disinfecting tendency of the acid fumigations, without any of their inconveniencies. M. Labarraque of Paris was the first to propose the employment of these substances as disinfecting materials; and Mr. Alocock has lately published an interesting pamphlet on their application, not only to the purposes now particularly referred to, but under several other circumstances of disease. To the article PHARMACY the reader is referred for an account of the preparation of these substances, and they are now prepared by Mr. Beaufort, for disinfecting animal food as well as for preventing the spread of contagious disease.

Typhus icterodes, yellow fever. The student, by referring to the nosology, will find that Cullen places this as a species under the genus typhus; and on this account it falls here to be considered. The remarks which we have already introduced under the general head of fever, and the disquisition in which we have already engaged, both in the preliminary part of the present article and when considering the existing causes of fever generally, might seem to supersede the necessity of any lengthened account of the symptoms, sources, and treatment, of the malady now to be noticed; but it demands somewhat of particular consideration, inasmuch as it has occupied the pens of controversial writers for years, and its precise nature and habits are still the subject of dispute.

It is still, we say, a disputed point, whether there is any disease, of a specific and peculiar kind, to which the term yellow fever may legitimately apply, or whether all its forms are not merely modifications of endemic fever, or of a fever which owes its peculiarities not to the specific and abstract nature of its exciting causes, but to the local circumstances of soil, temperature, air, &c., of the places in which it breaks out and spreads. It would seem to us probable that this discussion has been agitated too much in the abstract, or under the supposition that the disorder must be absolutely one or the other:—either common, that is, excited by the ordinary excitants of fever; or specific, that is, equally independent of time, place, and circumstance, as is small pox, or measles. To our conception, we repeat, both yellow fever, and a form of disease afterwards to be commented on, the plague, seem to hold a sort of midway condition in respect of peculiarity or specific character; and that while both are communicable by means of a particular poison, and both susceptible of transportation from one country to another, the clime in either case, to which the virus is transported, must be naturally or artificially such as to assist in the consequent development and spread of the disease. Who, it has been asked, ever heard of the yellow fever in the north of Europe? but small pox we all know is a distemper which has appeared in the south and in the north, in the east and in the west.

In the present case, however, it behoves us to recollect that we are encyclopædiasts rather than essayists, and that it is our duty rather to concentrate the opinions of others than to prefer our own. Under this impression we deem it proper to present a general account and estimate of the

yellow fever from the writings of others, and, in this instance, we shall bring into requisition the very able author of the Study of Medicine, who, after treating of remittent fever generally in its various shapes and modifications, goes on to say, 'One of the severest and most fatal forms under which the malignant remittent shows itself is that of the yellow fever, so denominated from the lemon or orange hue which is thrown over the entire surface of the body almost from the first attack of the disease, and which gives it a distinctive feature. The heat is here also intense, the thirst extreme, and the vomiting strikingly obstinate; but not consisting of a colorless material, or the food which has been swallowed, but of a yellowish matter at the beginning and through the height of the fever, and of a chocolate colored colluvies towards its close.

'The common remote cause of this fever is unquestionably marsh miasm; and hence it holds a stationary abode in the swampy soils and morasses of the inter-tropical regions, exposed to a high solar heat, and perpetually exhaling a decomposition of animal and vegetable materials; and is found occasionally in all climates that make an approach to the same characteristic; where, in the language of the poet,

The rivers die into offensive pools,
And, charged with putrid verdure, breathe a gross
And mortal nuisance into all the air.

And, as almost every territory in which it has committed its ravages has given it a new name, it is as gorgeously arrayed with titles as the mightiest monarch of the east. From the depredations it has committed in the West Indies and on the American coast it has been called the St. Domingo, Barbadoes, Jamaica, and American fever: and from its fatal visitation on the Guinea coast, and its adjoining islands, the Bulam fever. In British India it is distinguished by the name of the jungle fever, and still further to the east by that of Mal de Siam. Nearer home, in the lowlands of Hungary and along the south of Spain, it is called the Hungarian or the Andalusian pestilence. From its rapid attacks on ships' crews that are fresh to its influence the French denominate it fievre matillote, as the Spanish and Portuguese call it vomito prieto, or black vomit, from the slaty or purplish and granular saburra thrown up from the stomach in the last stage of the disease, while, as its ordinary source is marsh lands, it has frequently been named paludal fever. Its more common name, however, in the present day, and for the reason already assigned, is yellow fever; and, when the attack upon new comers is slight, seasoning.

From its showing itself in so many parts of the world, and under circumstances so widely different, it is not to be wondered at that it should often be accompanied with a considerable diversity of symptoms, and consequently that the paludal fever of one quarter should be regarded by many writers of considerable authority as essentially different from that of another. But an attentive perusal of the origin and laws of febrile miasm, as I have endeavoured to explain them when treating of the remote causes of fever, will, I trust, be sufficient to account for all such local distinctions, and if not to prove, at least to render it highly probable, that they depend partly upon the state of the body at the time of the attack, but chiefly upon some modification in the powers or qualities of the febrile miasm itself, by the varying proportions of the co-operative agents of moisture, heat, stagnant air, and other auxiliaries which have not yet been detected, in their relation to each other in different places and seasons.

How far the yellow fever is capable of origination from any other cause than febrile miasm from marshy lands, we cannot at present determine. When, however, it has once firmly established itself and raged with severity, it is now very generally admitted that the effluvium from the body of the affected is loaded with miasm of the same kind, completely elaborated as it passes off; and that the disorder is from this time capable of communicating itself by contagion. And it appears far more probable that the fever at Cadiz in 1800, and that at Malaga in 1803, had their origin in contagion, or, in other words, in febrile miasm, produced by a decomposition of the effluvium from the human body, than from the same miasm issuing from a decomposition of marsh lands. And on this account I have rather preferred the trivial name of yellow to that of paludal fever, which is too limited to express its source in every instance.

From the different impressions produced on febrile miasm, under these diversities of origin and adjuncts, we find, independently of other discrepancies, that the fever it excites sometimes assumes a caumatic or inflammatory cast, sometimes a typhus, and sometimes a synochus, or, in other words, begins with the first and runs rapidly into the second or third. Generally speaking, the variety before us evinces the last of these characters, as does also the variety we have just treated of: the two varieties that yet remain will afford examples of a typhous and inflammatory bearing.

Its ordinary progress amongst those who are fresh to the tainted atmosphere is thus accurately described by Dr. Moseley, who, from its resemblance to the causus of Hippocrates, denominates it endemial causus. 'When a new comer is seized with a sudden loss of strength, and a desire of changing for rest, into every position without finding it in any, those symptoms which constitute the endemial causus may be expected. The following day, but sometimes within twelve hours from the first indisposition, the violence of the disease will commence thus: there will be a faintness and generally a giddiness of the head, with a small degree of chilness and horror, but never a rigor. Then immediately will succeed a high degree of fever, with great heat and strong beating in all the arteries of the body, particularly observable in the carotid and temporal arteries; flushings in the face; gaspings for cool air; white tongue, but tinged with yellow, after the retchings have commenced; excessive thirst, redness, heaviness and burning in the eyes; heaviness and darting pains in the head and small of the back, and often down the thighs; pulse quick, generally full and strong; in some cases

quick, low, and vacillating; skin hot and dry; sometimes with a partial and momentary moisture; sickness of the stomach from the first, which increases with the disease; and, immediately after any thing is taken to quench the thirst; retchings succeed in which bilious matter is brought up; anxiety with stricture, soreness and intense heat about the præcordia; great restlessness; heavy respiration; sighing; urine deep colored and but little in quantity. This is the first stage of the fever, and may continue twenty-four, thirty-six, forty-eight, or sixty hours, and this constitutes its inflammatory period.

The second stage begins with an abatement of many of the preceding symptoms, and the rise of others, sometimes with a deceiving tranquillity, but with perturbation if the patient should fall into a sleep; then a yellow tinge is observed in the eyes, neck, and breast; the heat subsides and sometimes with a chilness, but not with that sort of strong rigor which, when it happens, terminates the disease by sweat, or by copious bilious evacuations upwards or downwards. The retchings are violent, and turn porraceous; the pulse flags, but is sometimes high, and sometimes soft; the skin soft and clammy; the urine in small quantity, and of a dark croceous color; the tongue in some cases is dry, harsh, and discolored; in others furred and moist; there is confusion in the head and sometimes delirium; with the eyes glassy. This stage of the disease sometimes continues only for a few hours, sometimes for twelve, twenty-four, thirty-six, or forty-eight hours, but never longer.

In the third and last stage of the fever the pulse sinks and becomes unequal and intermittent, sometimes very quick; frequent vomiting with great straining, and noise in vomiting, and what is brought up now is more in quantity, and has the appearance of the grounds of coffee, or is of a slate color. Nothing can be retained in the stomach; difficult breathing; tongue black; cold clammy sweats; eyes hollow and sunk; yellowness round the mouth and temples, and soon after over the whole body.

These symptoms become gradually more aggravated, accompanied with subsultus tendinum, black urine, deadly coldness of the limbs, delirium, faltering speech, hæmorrhage, or oozing of blood from the mouth and nostrils, corners of the eyes, and ears; black bloody vomiting and stools; vibices, hiccough, muttering, coma, death.

After the first prostration of strength the disease runs on violently till the sensorial power is exhausted. Through its entire course, till the patient is sinking, the intellect is not particularly disturbed, and the organs chiefly affected are the abdominal; those which principally suffer in the malignant autumnal remittent of our own country, more especially the stomach and the liver. Hence the intense heat and anxiety about the præcordia, the saffron dye of the urine, the yellow tint of the skin, and the vomitings, first of a bilious and afterwards of a chocolate or sanguineous colluvies.

In some cases the disease opens with great vehemence and rushes forward at once to its acmé, constituting the second stage of Dr. Moseley. The patient is sometimes cut off in four-and-twenty hours; and, from the violence so suddenly committed on the liver, its proper function is instantaneously suspended, and, instead of an excessive emulgence of high-tinted bile, a chlorotic secretion takes place, which, forced into the sanguineous system, gives a ghastly lividity to the entire surface. Shortly after which, if the patient live long enough, the gorged blood-vessels of the inflamed and gangrenous liver itself, and sometimes also of the spleen or stomach, give way, and repeated tides of dark granulated grume, like the grounds of chocolate, are ejected by the mouth.

Mr. Pym has very forcibly described this overwhelming onset of the disease in the following terms: 'There is at the first attack a peculiar, heavy, or drunken appearance in the eyes; the head-ache is excruciating, and, confined to the orbits and forehead, has no remission; when it terminates favorably it is rarely attended with yellowness of the skin, which, if it do take place, is of a very pale lemon color. It runs its course from one to five days; is attended with a peculiar inflammation of the stomach, which, in most cases that prove fatal, terminates in gangrene, or in a diseased state of the internal or villous coat of that organ, accompanied with a vomiting of matter resembling coffee grounds, and a livid or putrid appearance of the countenance which it is impossible to describe; but those wishing to form an idea of it may see its fac simile in the countenance of any person with a florid complexion, during the burning of spirits of wine and salt in a dark room, as is practised in the game of snap-dragon during the Christmas gambols.'

In this state the disease is unquestionably contagious; and as Dr. Cullen has laid down contagion as a distinctive character of fevers originating from human effluvium, in contrast with those originating from the effluvium of marshes, Mr. Pym has endeavoured to draw a line of distinction between yellow fever in this state of intensity and in its ordinary career; contending that the former (to which he limits the name of Bulam fever) is in every instance derived from human effluvium, and consequently that the two must of necessity be distinct diseases. And, to make the distinction still clearer, he has ventured to assert that the symptoms of a more pallid or bloated countenance, together with that of black vomit, or the discharge of coffee-like grounds from the stomach, is peculiar to the contagious fever, and is rarely, if ever, attendant on that produced by marsh miasm even in its most impetuous and fatal course.

This distinction, however, is in both instances at variance with the history of the disease as it has occurred in most other parts of the world, and more especially with respect to the symptom of black vomit, which in its last stage, or severer incursions, is common to it, from whatever source derived. It occurred more especially in the fatal epidemic of Antigua in 1816, which was decidedly an offspring of marsh effluvium. The island had for some years, observes Dr. Musgrave, at whose description we have already glanced slightly, been peculiarly healthy; and the disease first showed itself in a swampy part of it, and amidst new comers, who were sailors,

but from a healthy ship, and themselves in good health on first landing. It soon spread widely, and at length indiscriminately, among all ranks, and conditions, and situations; among blacks and whites, the newly arrived, and the oldest settlers in town and country.

Nothing was better calculated than this fever to show that almost all the different kinds of fever that occur to us are capable of issuing from a common source or miasm, merely modified by contingencies; for, in Antigua, they all occurred in different individuals. The disease sometimes commenced as an intermittent or remittent, and sometimes in a continued type; it sometimes ceased in four or five days, which was its usual course, and sometimes terminated in an intermittent. The head was in some cases chiefly affected; in others the stomach, liver, or some other organ. Sometimes the patient died without hiccough, or black vomit, though he rarely recovered where these symptoms appeared: Dr. Musgrave recollects but one instance. Recovery was no exemption against a second attack. In new comers the tint was of a lemon hue; in natives, or assimilated constitutions, of a deep orange. The state of the atmosphere, at the commencement of the disease, presented nothing peculiar.

In the midst of the discrepancy between these two accounts there is still much that is concurrent; and quite enough to establish the identity of the two diseases, if an abundance of other evidence to the same purpose were not at hand. The fever of Mr. Pym, specifically characterised by black vomit, is represented as being peculiarly dangerous and fatal; in that of Dr. Musgrave, this symptom only occurred in the most dangerous cases of the malady. According to the latter, the severest and most deadly attacks were amongst the new comers; the mildest amongst the natives, or those whose constitutions were assimilated to the climate. The yellow hue of the former was of a deep orange; that of the latter a lemon color. Mr. Pym describes three species of fever as common to warm climates, but which differ from each other in their mode of origin, and diagnostic character. In that of least danger the color of the surface, he tells us, is of very deep yellow; in that of higher danger it is of a deep yellow; and in the disease before us, which is by far the most fatal, where there is any yellow at all, it is of a very pale lemon color; which is, in effect, the very hue ascribed to the severest cases of the Antigua fever by Dr. Musgrave, as the very deep yellow or orange is to the mildest. So that, examined by their external livery, as well as their internal disorganisation, there can be no doubt that the two diseases are the same. Mr. Pym appeals peculiarly, as a distinctive character of the Bulam fever, to the deadly and chlorotic paleness exhibited by the countenance in its latest stage, or most fatal incursion. But even this only shows that, in such case, the disease makes a mortal attack upon the larger viscera, and especially the liver, from the first; and demonstrates the proposition I have ventured to lay down, that, in proportion as this organ is severely affected, is its inability to secrete proper bile, or indeed bile of any kind; and, consequently, that if the irritation only reach a certain point, the secernents will be stimulated to emulge a larger quantity, and of a deeper hue; a considerable portion of which, in consequence of such irritation extending to the neighbouring absorbents, will be sent back into the sanguiferous system, and produce the orange tinge, which, in the description of both these writers, peculiarly marks the disease before us in its less fatal attacks. While, if the febrile incursion be so violent as totally to derange the function, and still more the structure of the liver, no bile will be secreted at all, or, if secreted, less in quantity, and consequently less diffusive in color; and hence only conveying a chlorotic or livid tinge to the face, which, at the same time, exhibits a bloated fulness from effusion or debility of vascular action.

Yet, after all, it is not denied by Mr. Pym, nor, so far as I know, by any of the writers on the American or Andalusian fever, that the yellow fever from marsh miasm ever evinces either of the symptoms that are so essentially ascribed to the bilious remittent produced by contagion; but only that it is rarely, if ever, to adopt Mr. Pym's own words, attended with the fatal symptoms peculiar to the Bulam fever, viz. the black vomiting, and a peculiar bloated appearance of countenance.

There would, however, be an almost insurmountable difficulty in reconciling these different descriptions of the same disease, in consequence of Dr. Musgrave's telling us very decidedly that not a single instance occurred in the Antigua fever of its being received by contagion, were there not strong reason for believing that this explicit writer suffered himself to be deceived on this point; most probably, like Mr. Pym, from too close an attachment to the doctrine laid down by Dr. Cullen, that the fever from marsh miasm does not produce contagion, which is specifically a result of a fever from human effluvium.

It is impossible to peruse the history of bilious remittent in warm climates, offered from all quarters, without seeing that it may and does originate from both sources; each sometimes operating alone, and sometimes in conjunction with the other, as was probably the case at Antigua, and certainly the case in the yellow fever that raged at Philadelphia in 1793; in which, says Dr. Rush, there were for several weeks two sources of infection, namely, exhalation and contagion. The exhalation infected at the distance of 300 and 400 yards; while the contagion infected only across the streets. The more narrow the streets, the more certainly the contagion infected. Few escaped it in alleys. After the 12th of September. the atmosphere of every street in the city was loaded with contagion; and there were few citizens in apparent good health who did not exhibit some mark or other of it in their bodies, particularly a preternatural quickness in the pulse, which occurred in negroes as well as in whites; and in a few who had had the disease before.

That febrile miasm, produced from human effluvium is less volatile than that from marsh miasm, and consequently more limited in its range of infection, is consistent with common

observation. It is sufficient to observe, on the present occasion, that the disease thus issuing from two distinct sources, was one and the same in its general symptoms, and yielded to a like treatment, thus establishing satisfactorily what, indeed, Dr. Rush himself does not seem to have apprehended, that, though remotely issuing from two distinct sources, it was immediately excited by a common miasm thus doubly generated, and which was only modified in its action by the nature of its origin, or by contingent powers.

Unfortunately the practitioners in warm climates have differed as much in their therapeia as in their ætiology; and apparently the cause that has produced the one has produced or greatly influenced the other. Mr. Halliday, alarmed at the debility which the system will have to encounter in the second stage of the disease, or as soon as it has run through its inflammatory career, shuddered at the thought of the lancet, commenced with slight purgatives of sulphate of magnesia and manna, and immediately afterwards had recourse to the bark. The practice of Dr. Hillary was something less timid; for he allowed an abstraction of from twelve to twenty ounces of blood on the first, and even in a few cases again on the second day, according to the patient's strength and constitution. While Dr. Rush, on the other hand, regarding the inflammatory impetus as the sole cause of danger, boldly resolved to lay prostrate if possible the morbid Hercules at its birth, by bleeding according to the state of the pulse, two or three times a day during the first two days, and by following up the same plan as long as a single germ of inflammatory diathesis should continue manifest. 'I paid no regard,' says he, 'to the dissolved state of the blood, when it appeared on the first or second day of the disorder; but repeated the bleedings afterwards in every case when the pulse continued to indicate it. It was common to see sizy blood succeed that which was dissolved. The disordered appearance of the blood I supposed to be an effect of a certain action of the blood-vessels upon it. The presence of petechiæ did not deter me from repeating bloodletting where the pulse retained its fulness or tension.' And he affirms that both petechiæ and vibices disappeared in various cases after bleeding. This plan he often pursued through the fifth and even the seventh day, in the course of which period from 100 to 120 ounces of blood were frequently taken away by six or eight applications of the lancet.

His purgative plan was not less alert. Ten grains of calomel and fifteen of jalap were the force with which he opened his remedial attack, and which he repeated every six hours till the alvine canal was sufficiently evacuated. This mode of treatment, he tells us, he was led to by accident; and with it he became as successful as he had been unsuccessful under the tame and more established method.

Yet it is the boast of those who have pursued this tamer, and formerly more established method, that though less striking it has in the general balance of the account proved more salutary than the formidable plan of their antagonists.

There is not, however, necessarily any opprobrium medicorum in this discrepancy; for it is probable that in different situations, or under different circumstances, both plans have been equally judicious and equally successful; for we have seen that the disease, under different incidents and coadjutants, has exhibited every variety of violence, and inclined to almost every variety of febrile type. Where there is not much impetuosity in the onset, no great derangement or prognostic of inflammatory congestion in the larger viscera; where the remissions are regular and the epidemy is pretty uniform in its character; large and repeated bleedings, as a general rule, must prove mischievous. They will not shorten the period of the disease, but they will convert the remittent into a continued fever; and we shall in the latter stage of its course stand woefully in need of that strength which we shall have squandered away at first, if we have commenced with profuse venæsection.

On the contrary, if the disease make its incursion with great impetuosity; if the pulse be full and strong; or even if it be only hard, and there be great tendency to inflammatory congestion in any of the larger organs, as the head, the chest, or, as is far more common, the stomach, the spleen, and the liver; we cannot well be too bold both in bleeding and purging; and the plan laid down by Dr. Rush is by no means an exaggeration of what ought to be pursued. It may be that eight-and-forty hours, or even twenty-four are the whole we have to work in; and unless we, so to speak, can stifle or lay prostrate the sensorial power, and thus completely break down the inflammatory diathesis by debilitating and relaxing the living fibre or solidum vivum, rather than by diminishing the moles movenda, the organs mostly affected will, in all probability, become gangrenous, in a day or two the oppressed blood-vessels will give way, and we shall have a chlorotic or livid skin, cold extremities, black vomit, and all the other apparitors of death, before the tamer plan of aperients and diaphoretics could have time to produce the slightest impression on the system. Generally speaking, it will be best to bleed in an erect position; for the sensorial excitement, which is what we are principally to aim at, is cut down by syncope which an erect position will soonest induce, and we may hence save the expense of several subsequent bleedings.

There is no doubt that, by a practice thus active and resolute, very vehement attacks of the yellow fever have sometimes been subdued in a few days. But let not those who have thus triumphed conceive that by the same process they would as soon put to flight less violent incursions of the same disease that have been healed in a different manner; for the more acute the disease the shorter its duration in most instances; and hence, had no medical treatment whatever been resorted to, the fever might have run through its course whether fatally or happily in a less period than if it had commenced more leisurely and insidiously. Yet it is very far from being always true that an early return to health is the consequence of this daring practice, however judiciously it may be had recourse to, and though it may have been the only means of rescuing the patient from death; for the double debility induced by

the disease and its remedy have often laid a foundation for dropsies and other cachexies which have required years to master, and which have sometimes never been mastered at all.

Dr. Pinkard, in his Notes on the West Indies, has given a very interesting description of his own sufferings under this disease, and of the remedial process to which he had recourse. His attack commenced in the more common manner, slowly and insidiously, and demanded eight or nine days to reach its acmé. His head, stomach, and at last his bowels, were severely affected, especially the first; but his intellect continued sound, and, though the symptoms were vehement, there seems to have been little tendency to that violent visceral inflammation which in the stage of debility is so apt to produce gangrene; and consequently he had no black vomit. He lost twelve or fourteen ounces of blood at the commencement of the disease, and took a strong dose of calomel, which considerably relieved the pain in his head and eyes, and diminished the restlessness; but the thirst, heat, and dryness of the skin, were still intense; and his weakness became extreme. Affusions of cold water, old hock, opium, and bark, were made use of in profusion, and each seemed to afford great relief. Yet on the subsidence of the fever he represents his feebleness as most deplorable, and such as it appeared impossible to recover from. Here a mere use of the lancet could have been of no avail, and, had not the author most judiciously forbade its further employment, in all probability he would not have been the historian of his own case.

Mr. Pym speaks with a very just discrimination on this subject, in observing that while the Bulam fever, or the disease in its most violent attack, is relieved by free venæsection, the yellow fever, more properly so called, from the brighter hue on the surface, or, in other words, that which is slighter in its incursion, will not often endure the lancet. Dr. Musgrave's statement seems to oppose this assertion; for he distinctly tells us, that blood-letting in both forms is our sheet anchor; the only pillar on which we can securely rest any hope of extensive success. The Antigua fever seems to have exhibited great severity in most instances, and hence called for a courageous course of practice, with perhaps few exceptions. Yet the following paragraph proves that it did admit of exceptions, and softens down almost to unanimity a clash of opinions and mode of cure, which after all is more ostensible than real. 'We have repeatedly,' says he, 'with success taken upwards of forty ounces of blood at one bleeding. With equal success we have in several cases renewed the bleeding up to the third, and even fourth time; but, generally speaking, those that require such reiterated evacuation, evince an obstinacy not likely to admit of a favorable result, under any mode of treatment. It must also be remembered that every one who applies for assistance is not alike able to bear this liberal depletion.'

The reader will have observed that Dr. Good, throughout the whole of the extract that we have given, assumes an essential identity in different fevers, or in fevers that go under different denominations, and imagines their varieties to be rather incidental or circumstantial than dependent upon varieties of general excitant. It will further have been observed that his opinion on the subject of fever's requisites, in the way of treatment, is that endemic characters and epidemic peculiarities, and other particulars which regulate the degree of force or vehemence with which the disorder makes its attacks, are to be taken into account in the regulation of practice, rather than the name or abstract peculiarities of the distemper itself. In these assumptions and inferences we entirely accord, and are disposed to think that, had they been more generally admitted and acted upon, much of mere verbal controversy might have been saved; as, however, the subject of yellow fever, and the question of its specific character and contagious quality, are still interesting and unsettled, we shall, previously to the conclusion of the present section, extract Dr. Gregory's succinct and able account of the matter, in order that the reader may be furnished with two of our best authorities, that have taken the pains to concentrate the scattered accounts, and reconcile the discordant opinions of those who have investigated the subject. We may first take occasion to say that the reader will find the topic handled in a very able manner by Sir Gilbert Blane, in his Elements of Medical Logic. Dr. Gregory himself speaks of the essay to which we now refer as containing a very luminous view of the yellow fever question, and one which almost precludes the possibility of future ambiguity. The section of Dr. G.'s remarks on the yellow fever is as follows:—

Most of the genuine febrile diseases of hot climates appear to have a bilious tendency. Both the inflammatory and the intermittent and the remittent endemics of those countries are frequently accompanied with a yellow color of the skin, and other symptoms, supposed to denote that the functions of the liver are materially disturbed. This is particularly the case in the West Indies, and the common fever of the country is, on that account, known under the familiar appellation of yellow fever. Into the symptoms and treatment of these forms of disease, however, it is not my intention to enter. They are noticed only in order to contrast them with the epidemic yellow fever, such as that which raged in the West India Islands and at Philadelphia in 1793; at Cadiz in 1800; at Malaga in 1803; at Gibraltar in 1804 and 1813; and again at Cadiz in 1819. As this particular form of fever has been observed in all these situations to exhibit very much of the same defined characters, and as it presents some peculiarities which may distinguish it from other epidemic fevers, I shall give a short account of its symptoms and progress, of the appearances found on dissection, and of the most approved systems of treatment.

The attack of the epidemic yellow fever is ushered in, in the usual way, by languor and rigors. There is sometimes a peculiar dejection of countenance observed, with a remarkable aversion to the least motion; at other times there is an appearance of inebriation. The face is flushed; but the most prominent of the earliest symptoms is head-ache, of a very peculiar kind

It is exceedingly severe, and referred to the forehead and bottom of the orbits. The eyes appear dull, glassy, suffused, and protruded. The tongue is at first furred and moist, and trembling, but by degrees it becomes dry and black, or sometimes of a fiery-red color. The heat of the skin is but little increased. The patient sometimes lies in an almost insensible state, but extreme restlessness has also been noticed.

To this succeeds the second striking feature in the symptoms of the disease, great irritability of the stomach. The matter ejected is very seldom bilious, or, if it is so at first, it speedily loses that character. For the most part it is slimy and tasteless, and adheres in small flakes to the sides of the containing vessel. As the disease advances, it assumes a dark color, and comes to have the appearance of coffee-grounds. This is the vomito prieto, the black vomit, which may be considered the characteristic feature of this disease, as much as buboes and carbuncles are of the plague. The dejections have a tarry appearance. There is often noticed a total suppression of urine, which, like the black vomit, is a fatal symptom. Hiccough, hæmorrhages, and petechiæ, have been observed in some cases, even from an early period.

I have retained to the last the mention of that symptom which gives name to the disease—yellowness of the skin, but it is not of that importance that might have been anticipated. Many cases indeed run through their whole course without exhibiting it; but when it appears early, or when it assumes a leaden or livid cast, it is to be considered an unfavorable symptom. A few other peculiarities in the disease are all that remain to be noticed. The yellow fever is occasionally attended with an ulcerated state of the throat. A fatal termination has often happened in the most unexpected manner, a very singular remission of all the symptoms taking place about sixty hours from the first attack, and raising hopes which are soon to be disappointed. Death is sometimes observed to be preceded by a low muttering delirium; at other times the patient has sunk exhausted, but with the intellect quite unimpaired.

The usual duration of the yellow fever is from five to seven days. If the patient passes the sixth day without the recurrence of black vomit, or suppression of urine, his chance of recovering is much increased; but typhoid symptoms occasionally supervene and prove fatal. Relapses in this disease are very rare.

Upon dissection very few appearances present themselves which can be considered as throwing light on the pathology of the disease. The body has been observed speedily to become livid. Yellowness of the skin has sometimes been first noticed to occur after death. A state of turgescence of the cerebral veins has been described, and occasionally there has been observed a peculiar redness of the inner coat of the stomach. The gall bladder is generally found distended with dark and viscid bile. The structure of the liver is not found to be altered. It sometimes assumes an ash color.

Such are the most usual symptoms of the yellow fever. They will be seen to bear some resemblance to those of the plague, and the analogy between these diseases has been urged with much force by John M'Grigor. A more important analogy may be traced between the epidemic yellow fever and the genuine typhus fever of this country; and there can be no doubt that the former bears the same relation to the endemic fever of the West Indies, that typhus does to the common synochus of Europe. It is probably called therefore the typhus icterodes. The cause of the yellow color of the skin in this fever has been made a subject of enquiry. By some it has been attributed to disordered function of the liver, by others to bile absorbed from the intestinal canal, without hepatic derangement. Sir Gilbert Blane has thrown out the idea that it may be owing rather to a depraved state of the red globules of the blood. In whatever way this question may be decided, it is perfectly clear that the state of the biliary organs has very little to do with giving a character to this formidable disease, which is to be viewed as one of the most aggravated forms of continued fevers. In respect to mortality, the yellow fever may even take precedence of the plague. At Gibraltar, in 1804, the disease raged among the inhabitants uninfluenced by any distinctions of age, sex, or condition. The deaths amounted to somewhat more than one in three, a proportion, according to Sir Gilbert Blane, considerably above the devastation of the pestilence of the Levant.

The treatment of the epidemic yellow fever is a point which has attracted great attention from all classes of enquirers; but their observations tend only to show that it is a disease of so singularly malignant a nature, as, in a large proportion of cases, to bid defiance to all the efforts of art. This is particularly the case when the disease first makes its appearance in any town or district. The peculiar combination of circumstances, whether in respect to local situation, or of the state of the atmosphere, or of the constitution of the inhabitants which gives the peculiar feature of malignity to the symptoms of the disease, operates also against the practitioner, and deprives him of all his most powerful means of combating fever. The severe head ache, which characterises the early stages of the disease, naturally suggested blood-letting as a probable means of relief, but experience has proved that, though occasionally, it is not generally beneficial. The blood, when drawn, separates very imperfectly; upon exposure to air it does not acquire its usual florid color, and scarcely ever exhibits a buffy appearance. The great object which it is found necessary to keep in view, in the treatment of the disease, is the allaying that excessive irritability of the stomach which leads to the black vomit. Calomel given at first in a smart dose so as to operate freely as a purgative, and repeated in smaller doses at intervals of three or four hours, so as to keep up this effect, was the most approved practice among the English practitioners at Gibraltar in 1813. Along with calomel were occasionally united aloes and gamboge. In the exibition of these medicines no time was to be lost, for it was only by their speedy and full effect that the

prevention or relief of the vomiting could be insured. Pediluvia and tepid sponging were found to be beneficial. Under certain circumstances the warm bath even was administered with good effect. Cold applications to the forehead and hands occasionally served to relieve the urgent head-ache. When the powers of life appeared to fail, it is unnecessary to say that stimulants and cordials were had recourse to; subacid drinks were given, and a strict antiphlogistic regimen pursued throughout the whole disease. The same rigid attention to diet and regimen were required during the period of convalescence.

I have stated that among the points in dispute regarding the yellow fever, is the question of the identity of the epidemic yellow, or Bulam fever, with the endemic fever of the West Indies. Upon this question an opinion has already been given. The other topics of controversy are, first, whether the disease be always imported, or whether it can ever be generated by a combination of common or endemic causes; secondly, whether, being once received into a town, it propagates itself by contagion; and, thirdly, whether those who have passed through the disease are susceptible of it a second time. These are all important questions, the replies to which are not so obvious as to that which has already been under discussion, and they involve the most difficult part of the controversy.

The first question is undoubtedly one which should be answered with some caution. Many circumstances connected with the early appearance of the epidemic yellow fever at Philadelphia in 1793, and at Gibraltar in 1804, strongly favor the idea of its having been in those situations an imported disease. Several other facts, however, might be adduced which militate against the universality of this doctrine; and there appears nothing inconsistent in allowing that, under peculiar circumstances, the genuine malignant yellow fever may be engendered by a combination of endemic causes. With regard to the second question, no reasonable doubt can surely be entertained by any candid, intelligent, unbiassed man, that this disease, being once received into a town, is contagious. The evidence in favor of this opinion is certainly as strong as for that of the contagion of typhus or of plague. Whether the yellow fever bears the greater analogy to the former or the latter of these diseases may indeed be disputed. We may hesitate, that is to say, whether the contagion of yellow fever be common or specific; but that the disease is propagated by contagion of some kind cannot be questioned, after the ample experience which has been had, both in America and Europe. If any doubts could have been entertained while the disease occured only in the West Indies, in consequence of the resemblance of the epidemic to the endemic fever of those islands, they must have yielded to the obvious arguments suggested by its appearance in Cadiz and Gibraltar. The contagious nature of the disease, it may be remarked, is a perfectly distinct question from that of its foreign or endemic origin.

Some of the laws of contagion of yellow fever appear to be ascertained with tolerable accuracy. Its latent period varies from two to eight days. Ten days are, I believe, the longest period recorded of yellow fever appearing after the exposure to the contagion, and removal to a freely ventilated atmosphere. The contagion of yellow fever has a peculiar range of atmospheric temperature, but on a higher scale than that of the plague. It has never been known but in those countries and at those seasons, when tropical heats, that is, of eighty degrees of Fahrenheit, or upwards, prevail. It never fails to disappear as the winter approaches. It is certainly a singular circumstance in the history of the yellow fever that it has never been seen, except in one instance, but on the shores of the Atlantic Ocean.

The last circumstance which it is of importance to notice, in the history of the yellow fever and the laws of its contagion, is the question whether it can be taken a second time. The answer is a very short one. Although a few well-attested instances to the contrary have been recorded, still a most extensive experience has satisfactorily proved that the immunity from second attacks is nearly complete, and that it forms one of the most striking characteristics of this remarkable disease.

Hectic fever.—This is the last species in Cullen's order of febres; but it is introduced improperly, as it varies much from all other kinds of idiopathic fever in being without that symptom which is so remarkably characteristic of the febrile condition, depression of animal power; for it is observable that from the first the subject of hectic fever has for the most part an alertness and springiness of feeling which is often, indeed, mournfully in contrast with the wearing and wasting character of the disease. Hectic also is for the most part decisively the product of topical affection, which presents another inconsistency in the classification, inasmuch as Cullen's theory supposes genuine fever to be a general, not a local, disorder.

Symptoms of hectic fever.—This is essentially a remitting fever, having its remissions and exacerbations fairly marked; these occur twice in the day for the most part, the first about noon the other about six o'clock in the afternoon; and which last exacerbation is certainly the most considerable. Hectic fever is prominently marked by a circumscribed red spot on the cheek alternating with paleness. The tongue is clear and red, and, as we have above observed, the animal powers are, comparatively with other febrile states, free from oppression. The brain does not appear to be affected in hectic. The appetate is not necessarily impaired as in other kinds of fever. Thirst is not so urgent. Emaciation is for the most part extreme, and towards the last a diarrhœa almost invariably takes place. But the great characteristic symptom of this malady, or rather of this index of other malady, is the colliquative sweating which takes place in the night and continues till the morning; so that the patient, when he is about to rise, finds himself bathed in perspiration, which perspiration for the most part is principally conspicuous about the head and neck, and breast and shoulders, or at any rate it is not diffused over the whole body so generally as the sweat which terminates the paroxysms of other fevers.

Such are the characters of hectic when fully marked, and when attendant upon some wasting process of disorganisation that is going on in the system, especially an ulceration of the lungs. When, however, in the course of mentioning other maladies, we state that hectic is an accompaniment, it must not be supposed always that we speak of the symptom in this unequivocal and extreme manner. In the preliminary remarks on the nosology it will be seen that we consider hectic to be a mode of disordered manifestation very common to scrofulous or lymphatic ailments, and occasionally, when the constitutional tendency has this verging, if we may so say, more or less of hectic irritation will easily be induced by any circumstance which excites morbid irritation in the frame.

With respect to the treatment of hectic nothing requires to be said in this place, since its management is the management of the disease upon which it depends. Indeed, as decidedly a symptomatic disorder, and as widely different from all other disorders to which the term fever has been appropriated, we only introduce it here in conformity with the nosological arrangement we have adopted. We shall have again to allude to it especially under the head of pulmonary consumption.

344. Order 2. Inflammation. For some remarks on the general pathology of the inflammatory state we refer to our introductory proem, and the farther consideration of this state will be found in the article Surgery. It is only for us, in the present instance, to delineate the general symptoms of inflammation, mark its diagnosis from other diseases, and give an outline of the principles which should regulate its treatment. We shall then be prepared to go through the several maladies contained in the order.

Symptoms of inflammation.—It will be seen, by turning to the nosology, that topical pain with synochal fever, lesion of function, and the blood exhibiting upon being drawn the inflammatory crust, are considered by Cullen as the main characteristics of the state now to be commented on. But there is an incorrectness in these assumptions; for the local disorder shall sometimes, as in the instance of what is called passive inflammation, be accompanied with a sympathetic fever, which has not a synochal aspect; and the buffed blood is sometimes present when no inflammation exists, while it is occasionally absent under the presence of inflammation. We may remark by the way, and before we proceed in the delineation of symptoms, that buffy crusts on the surface of blood should be always recognised with some reserve as an index of the inflamed state; for, as Mr. Thachrah very properly remarks, in his excellent treatise, it is sometimes rather the indication of very different circumstances from those of excitement. There is a good deal of difficulty connected with the theory of buff on blood, but one particular connected with its rationale is pretty clearly made out, and that is, that the slowness with which the separation takes place of the constituents of blood in some measure regulates the quantity of buff. Now this separation is effected more or less tardily as the components of the mass are more or less intimately combined; and when the blood is in a condition of more than common thinness, as is the case under several circumstances of extreme debility and lowness of vital power, the tardiness of the coagulation will cause the appearance on the surface of buff, which is then any thing but a token of inflammation. We merely mention this particular by way of caution against hasty and unqualified inference, and not at all with a view to invalidate the criterion now under remark; for certain it is that, cæteris paribus, buff on blood must be considered as proof of the presence of inflammatory excitement.

Pain, heat, hardness and quickness of pulse, with external redness and swelling, if the parts implicated are so superficial as to be obvious to the senses, are noted down by authors as indices of inflammation. The first symptom, pain, would not seem of difficult explanation, when we recollect the distension of the parts engaged with inflammation: but, besides the mechanical source of pain, if it may be so expressed, there is an increased sensibility referrible to the augmented excitement, and connected with the laws of vital influence. Pain, moreover, often exists without inflammation, so that its kind rather than measure is to be taken as the characteristic symptom—it is what is called lancinating and acute in the first stages, and afterwards throbbing or pulsatory. It is also increased by pressure, should the organ affected be so situated as to be within the reach of pressure; whereas pains arising from other sources are oftentimes mitigated by pressure.

Heat is a symptom of inflammation, but not perhaps necessarily or characteristically so; when it takes place it is in superficial parts, or in parts at a distance from the centre and source of circulation, and it is, like the pain itself, partly referrible to increased nervous excitement, and partly to be attributed to the more than ordinary quantity of blood rushing through the vessels that are implicated in the disorder.

Increased redness is the necessary consequence of inflammatory condition; for where more blood is flowing through vessels than they ordinarily convey, and when moreover new vessels shoot out which are immediately supplied with their appropriate fluid, more than common redness must be the result.

Swelling too, or increased bulk, naturally and necessarily grows out of the inflammation, since the distended and newly formed vessels must by occupying space increase bulk; unless where the structure of the part is resisting and not loose, in which case no swelling will be perceptible.

In respect to quickness of pulse, this almost of course ensues from the systematic excitement which the local irritation causes; and with quickness there is for the most part a hardness or wiry feel in the pulse, as if there was a resistance to the velocity and perturbation excited through the mass of circulating blood.

The above are the symptoms of the first stage of inflammation. When the second or suppurative stage is about to commence the lancinating and tight kind of pain becomes changed to a sensation as if of throbbing or beating; a feeling also of fulness takes the place of tightness; the pulse

from being hard and wiry becomes softer and fuller, and when pus is formed to any extent we have almost always the occurrence of rigors.

The third or gangrenous stage is denoted by the sudden cessation rather than change of pain, while the pulse instead of becoming full as in suppuration acquires a very great rapidity, and occasionally becomes irregular; the patient although he may express himself relieved, and fancy that all is going on well, soon loses the natural fulness of feature and ordinary expression of countenance, and also feels incapable of muscular exertion; in a short time becomes wandering and delirious, hiccough supervenes, cold sweats break out, and death soon closes the scene. Many are the instances in which from an individual expressing himself relieved and improved, he has become a corpse in less than forty-eight hours; and the medical practitioner ought always to be aware of pronouncing his patient better merely from the subsidence of the pain, while the pulse, instead of coming down to the standard of health, increases in celerity. Rigors then, let it be repeated, are the leading features of suppuration; subsidence of pain with rapidity of pulse marks the commencement of gangrene.

It may be remarked, before we terminate this outline of inflammatory symptoms, that the disorder sometimes instead of tending to suppuration terminates by effusion, as indeed we before slightly intimated when speaking of inflammation in our introductory section; when that is the case rigors do not follow the subsidence of the irritative state, but an approach to hectic manifestation takes place of the primary excitement; when the effusion is of serum one species of dropsy is formed, as we likewise have already noticed, and when it is coagulable lymph that is thrown out adhesions are effected often between parts that were originally in a state merely of contiguity, and a new kind of impediment to function is produced. Thus in the first stages of inflammation of the pleura we have tightness of breathing occasioned by the inflamed state of the membrane, and afterwards we have difficulty in the respiratory process from the two layers of the pleura being glued as it were together, or being attached to the parietes of the chest on the one side, or the surface of the lungs on the other, in the same adhesive or organic manner.

Of the kinds of inflammation.—Phlegmon and erythema, are, it will be seen, the two species marked in the nosology. A phlegmon may be described as an inflammation of a bright red color, of a regularly circumscribed extent, and marked by a general disposition to the suppurative process. An erythema is characterised by a less deep color, by being more superficial and spreading than circumscribed and deep, and by manifesting a tendency first to serous effusion and next to gangrene, rather than showing a disposition to suppurate. Boils are phlegmons, as are the pustules in what are called distinct small-pox. Scarlet fever, measles, and the confluent small-pox, more especially the first of these maladies, are rather instances of erythematic than phlegmonous inflammation. Phlegmons are not confined to membranous expansions, but are, as above intimated, found to penetrate muscular or fleshy substance, while erythema is rather a disorder of membranes.

Inflammation, however, it should be remarked, is not only modified by the constitutional energy of the individual, and the texture which it implicates, but it has a dependence further upon the nature of its exciting source. Thus the inflammation of rheumatism is different from ordinary inflammation, though the habit of the sufferer be the same in either case, and even though the texture implicated be the same; thus the erythema of scarlet fever and that of erysipelas are in one respect alike, in another dissimilar; again scrofulous and venereal inflammation differ from common inflammation in several particulars as in other places will be duly noticed, so that, in considering both the symptomatology and the rationale of the inflamed state, varieties from exciting sources and constitutional predisposition must always be taken into the account.

On these sources of inflammation, we may extract the following statements from Dr. Gregory.

1. Mechanical and chemical irritants. The phrenitis of infants has been traced to the irritation of teething, gastritis to poison, interitis to the presence of hardened fæces; nephritis to calculus in the bladder; ophthalmia to dust and sand; erysipelas to leech bites, or the distension of the skin from dropsy.

2. Cold is the most important of all the exciting causes of internal inflammation. There is scarcely a form of it that does not occasionally owe its origin to cold, and many inflammatory affections, as rheumatism and pleurisy, have no other cause of the smallest practical importance. The period of time that elapses between the application of cold and the occurrence of inflammatory symptoms is subject to great variety. In the case of sore throat, it often follows in the course of a few hours. In that of acute rheumatism a week or even a fortnight has been known to elapse. In what manner cold operates as the cause of internal inflammation has been a constant subject of enquiry with all pathological writers, but it is still involved in great obscurity.

3. Some forms of inflammation, which to a superficial observer might appear to arise without any assignable cause, have their origin in a peculiar state of body, the nature of which is not always understood, but which the older physicians supposed to consist in some morbid state of the fluids of the body. This piece of pathology is exemplified in the phenomena of gout; to the inflammation of absorbent glands occurring in scrofulous children, on the approach of winter; and in the pustular eruptions to which young persons are subject about the age of puberty. The presence of fever unquestionably leads to local inflammation, and hence it is that, in the progress of typhus, thoracic or abdominal inflammations so frequently supervene.

4. The presence of a morbid poison in the system is a frequent occasion of internal inflammation. This principle is amply illustrated in the phenomena of the plague, small-pox, measles, and other exanthemata. It is equally exemplified in those of secondary syphilis, where the inflammation of the fauces, or of the iris, or of the

joints, is obviously attributable to the presence of a morbid poison. Closely allied to this, in a pathological view, is the important, but well ascertained fact of the origin of many inflammatory affections from contagion. There is a species of contagious catarrh. Two species of cynanche are contagious. There is a contagious form of ophthalmia. Erysipelas is contagious under certain circumstances; so in all probability is dysentery There is reason to suspect that one of the forms of peritoneal inflammation is occasionally propagated in the same way.

5. The last cause of internal inflammation which it will be necessary to notice in this general view of the subject is metastasis, or the translation of inflammation from one organ or structure to another. This is a very curious point in pathology, sufficiently established indeed, as a mat- of fact, but the reasonings concerning which are hitherto very obscure and imperfect. It is exemplified in the ophthalmia which succeeds gonorrhœa; in the inflammation of the testicle which succeeds the mumps, in the inflammation of the pericardium which succeeds rheumatism. In what manner the metastasis is effected has never yet been developed. It appears, however, that to sympathy from similarity of structure, something may be referred; for in almost all cases of metastasis it will be found that the structures primarily and secondarily affected have an affinity to each other.

In the treatment of inflammation it will be of course right to consider the exciting cause, the period of the disease at which we are called upon to attempt our remedial measures, the degree of force by which the inflammation is characterised, and the structure and habits of the part inflamed.

In acute, or active, or as it has been called sthenic inflammation, the immediate indication is of course to lessen the action of the vessels, and diminish the quantity of blood flowing through them; and to effect this purpose venæsection, purging, refrigerants, sudorifics, emetics, and counter-irritants are had recourse to. Some have said that the three indications, which the treatment of the most sthenic inflammation involves, are to reduce action, to promote absorption, and to restore tone. In a MS. course of lectures which is now lying before us we find the following statements of opinion in reference to these indications. 'I would again call to your attention the principle previously inculcated, that while the most passive or atonic kind of inflammation supposes commotion and inordinate irritation, which we are called upon to subdue, on the other hand the most sthenic or tonic, if it may be so called, implies vascular debility. How, I would ask, is it possible for more blood to be forced through vessels than nature ordained them to convey, without such admission and transmission, being occasioned by a deprivation of tonic or resisting power to vis à tergo impulse; it may have been induced by that impulse, I grant, and have already indeed stated that it is so, but still the weakness is present, and part of the curative means should have regard to its presence. When then I place blood-letting, as it ought to be placed, at the front of remedial measures for the subduction of the inflammatory state, I would say that in thus necessarily withdrawing the vis à tergo impulse, we must be careful that we do not too much add to the weakness of the capillary vessels, which constitutes one of the links in the chain of the inflammatory state.' 'Again,' the lecturer goes on to say, 'it will be had in recollection, that I have intimated the impossibility of simple reduction of an inflamed condition of parts. The change which inflammation creates implies a degree of disorganisation; there is the production of new fibre and new vessel, and there is effusion either of lymph or of serum, so that the process of cure when in the most immediate and simple way implies some degree of absorption; and if we carry our weakening measures too far we may be likely rather to facilitate and encourage the tendency in some species of inflammation to effusion. Carrying these principles out to too great a length, some practitioners have proscribed blood-letting altogether, and Dr. Maclean has published a volume full of cases, in which inflammation was successfully treated by calomel and opium, omitting altogether the use of the lancet; but this appears a dangerous extreme on the other side, and there are many cases in which it would seem next to madness to attempt the cure of the disorder without even very considerable venæsection.' Thus far the lecturer, who, it will be seen, argues on the assumption of inflammation being constituted of weakness of vessel as well as of inordinate excitement; and, although we may not subscribe to his theory, or comply altogether with his practical principia, we may at any rate take from him the hint that the powers of the system, as well as the force of the disorder, ought to be taken into our calculation, when we are using the lancet to subdue inflammation.

It is a most important observation of Dr. Gregory that to a certain degree the part inflamed affects the treatment. 'Inflammation of a serous membrane,' says this very able writer, 'demands the copious and rapid abstraction of blood. That of mucous membranes does not bear the same extent of evacuation, nor does it so often require it. Erysipelatous inflammation is often successfully treated by bark and acids. Rheumatic inflammation is often under the control of certain drugs which have no effect upon, or which prove absolutely prejudicial in, common inflammation, I mean colchicum and opium.' In the latter clauses of this paragraph Dr. G. alludes, however, rather to the kind of disorder than to its locality; and besides the remarks go beyond the question of blood-letting, but they are altogether so important, and so deserving of practical recognition, that we could not resist the temptation of transcribing the whole.

Immediately upon an impression being made upon the system by large blood-lettings, in some cases of internal inflammation, Dr. Armstrong and others have recently recommended the practice of administering pretty considerable quantities of opium, such as three grains of the powder; and Dr. Uwins, in his recent treatise on affections connected with indigestion, proposes to explain the good resulting from this practice in the following way. It would seem that opium exerts a particular effect upon the small capillary system of

vessels which is proved by the tendency it has to lock up secretions. This effect is contractile, and we may then suppose that the medicine by contracting or lessening the diameter of the capillaries may prove preventive of that rush of blood again into them which is so apt to succeed to depletion of vessels. Whether this or any other principle be that upon which the good of opium after blood-letting actually depends, may be a subject of dispute; but, if more extended observation confirms the rectitude of the practice, it will not be right to wait for settling the rationale, before we adopt the measure; and, so far as our observation has gone, we are inclined to think very highly of it.

Purging is another important principle in the treatment of inflammation. By producing catharsis, we certainly accomplish a two-fold object, we call the action of the vessels away from the part affected, and diminish the irritative fever which has been set up by the local disorder. Some kinds of purgatives indeed as in the instance of elaterium by occasioning a general nausea, effect a sort of collapse over the whole frame, or to make use of a terminology that does not imply hypothesis, cause such a general impression upon the system as to abate the force of the disorder. In some cases it is desirable to accomplish this effect without expenditure of blood; and, when these cases occur, the medicine just named may be occasionally employed with happy effects. How far purging is requisite and admissible in inflammation of the bowels will afterwards be matter of enquiry.

Sudorifics are employed as anti-inflammatory measures with occasional good effect, by throwing the actions and the fluids of the system out upon the surface: these medicines, as mentioned under the head of fever, abate inordinate heat, divert the current of blood from the affected organs, and tend generally to equalise the circulation. Some medicines in the class of sudorifics, when employed in rather large doses, excite an emetic or a nauseating effect, and when they do so their modus agendi may be partly similar to the sort of purgation to which we have above referred.

Another mode of abating inflammatory action consists in the administration of those medicinals which, under the supposition of their possessing the faculty of reducing inordinate irritation, in an immediate or direct manner, have been termed sedatives; the term is however vague, or at any rate it is only expressive of an effect, and does not convey any precise notion of agency. Foxglove and the hydrocyanic acid may be instanced as two of the most conspicuous medicinals of this class.

Counter-irritation is the last means here to be noticed of remedying inflammation. It is a law of the system, that one irritation tends to modify and often to mitigate another, and it is partly in conformity with this law that epispastics and rubefacients are made use of as anti-inflammatory measures. Blisters to the back of the neck will often relieve an inflammation of the tonsil glands, and so forth. It is in the general way expedient that the high excitement connecting itself with the first stage of active inflammation be in some measure subdued before these counter-irritants are resorted to; otherwise by introducing a new excitant to the already morbidly excited frame, we may increase the evil that we wish to subdue. It is for example but seldom, unless in cases of long continued or chronic inflammation as it is termed, that blisters are applied with propriety before the use of the lancet.

On the subject of chronic inflammation we shall take the liberty of extracting the following remarks from Dr. Gregory, premising that the condition of vascular disorder, which this term is meant to denote, is somewhat obscure; indeed, when it is considered how very shortly inflammatory action produces disorganisation—occcasions the formation of new vessels—the effusion of coagulable lymph, and the consequent change of structural circumstance in the parts implicated, we cannot well imagine the presence of the disordered state, during any length of time, without the consequences now referred to; still there is, at times, a species of vascular irritation of a passive and chronic nature, which demands to be recognised, whatever terminology we may apply to the state. Dr. Baron, in a recent work of much ingenuity, has objected to the generally received principles of chronic inflammation, and has suggested whether the lymphatic system may not have much more to do than the blood-vessels in effecting those structural alterations which are usually referred to inflammatory action of a continued kind, whether of a common or specific character. Some of the continental pathologists have in part conjectured, and endeavoured to establish, the same principle of action; and have pointed out the lymphatic, and the sanguiferous capillaries, as the chief seats of those irritative actions which are usually designated chronic inflammation: the subject, however, is altogether somewhat obscure, and still open to farther research. In the article Surgery we shall have more particularly to refer to this subject, and shall here limit our disquisition to the above mentioned extracts.

Chronic inflammation, says our author, occurs frequently, and in almost every variety of structure; in the lungs, where it lays the foundation of consumption; in the brain, liver, spleen, and kidneys. All the serous and mucous membranes of the body are subject to it; and, in many cases, it proves a most formidable affection, as in chronic dysentery, and catarrhus sinilis. The substance of muscle appears to be the seat of inflammation in some forms of chronic rheumatism, the frequency of which disease shows that the fibrous membranes are in like manner affected. The skin is, of all textures, the least liable to chronic inflammations. This state of disease falls also within the observation of the surgeon. Gleet, inflammation of the prostate gland, scrofulous enlargements of absorbent glands, chronic ophthalmia and ozæna, or the chronic inflammation and ulceration of the schneiderian membrane, may be taken as instances.

One of the circumstances most deserving of attention in the pathology of chronic inflammations is, that it is sometimes a primary, and at other times a secondary, affection. By this latter term it is intended to denote that it succeeds

acute inflammation; and this is the most common form in which it appears. It is thus that it occurs in gleet and dysentery. But at other times it is not preceded by any symptoms of active inflammation. It begins almost imperceptibly; and its advances are slow, often exceedingly insidious, being unaccompanied by any symptoms which could betray, even to the experienced practitioner, the existence of such a disease. No where is this better exemplified than in the case of some forms of peritonæal inflammation; but the same thing has been observed also in cases of chronic inflammation of the membranes of the brain, and even of the heart itself. In these instances not only are there wanting all local symptoms of inflammatory action, but there are not even any constitutional symptoms; at least none of sufficient importance to attract attention. This, however, it must be confessed, is comparatively a rare occurrence; and it is much more usual for chronic inflammation, both primary and secondary, to exhibit local and constitutional symptoms; less in degree, but the same in kind, with those which accompany acute inflammation.

The local symptoms produced by chronic inflammation vary of course with the part affected. Sometimes, as in chronic laryngitis, there are local symptoms, but no affection of the constitution. When the general system is implicated, the symptoms are usually those of fever. The pulse is quickened; there is a white tongue, thirst, and some degree of restlessness. Occasionally, however, in a state of chronic inflammation, the tongue is clean, there is no thirst, but the pulse is feeble and languid, the extremities are cold, and the slightest exertion occasions fatigue, generally uneasiness and pain across the loins. All these symptoms mark a state, not of fever, but of atony and debility. The term asthenia has been applied with much propriety, by some pathologists, to express this state of the general system. Many of the protracted cases of bronchial inflammation, particularly those which occur in old people, exhibit, in the greatest perfection, the characters of asthenic inflammation.

The causes of primary chronic inflammation are involved in much obscurity. There is reason to suspect that cold has sometimes induced it; or mechanical irritation, as in the case of chronic inflammation of the brain, from spiculæ of bone; but it is seldom that we can attribute the disease to so obvious a cause. A scrofulous habit of body appears to favor the disposition to chronic inflammation; but it often occurs where it would be mere hypothesis to attribute it even to that obscure source. What the particular state of body may be which leads to the affection, in such cases, is in all probability inexplicable.

The nature of that action of vessels in which chronic inflammation consists has been long an object of research. By some it has been defined to be that state of increased action of vessels, which is neither so far subdued as to tend to resolution, nor so violent as to form abscess; but this goes only a little way in explaining the difficulty. From the appearance of the eye in some cases of chronic ophthalmia, and from the effects of the juvantia and ledantia in this and many other instances of chronic inflammation, it would seem probable that a relaxation of vessels prevails, rather than any increase of their action. It must be confessed, however, that this object of enquiry is obscure; and perhaps the truth, if it could be ascertained, would be found of no practical application. (Dr. G. here refers to the pathology of the French, and its similarity with the speculations of Dr. Baron.)

The effects, he continues, of chronic inflammation, or more correctly the local appearances presented during the state of chronic inflammation, vary with the texture of the part affected. A simple thickening of structure is a common appearance, both in serous and mucous membranes. Sometimes the thickening assumes the form which has been called tuberculated accretion. In serous membranes it leads to the extensive union of surfaces. Schirrus is generally accounted the effect of chronic inflammation in a glandular organ.

The origin of *tumors* in different structures is a subject that has excited much attention among pathologists. In many cases it is presumed that their growth is referrible to the same action of vessels by which all parts of the body are formed; but in other cases there is reason to believe that they may have had their origin in a state of chronic inflammation of vessels. Closely allied to tumors are tubercles; but the views which are entertained by pathologists of the origin and progress of tubercle will come better under discussion hereafter, when treating of pulmonary consumption.

The last effect of chronic inflammation which I shall notice is suppuration; and it is one of those which we have most frequent occasion to witness in practice. The fact of the formation of purulent matter in cysts and other structures, without any evidence of previous inflammation, was well known to John Hunter, who had particular views of his own regarding it. But they are unsatisfactory, and, until further light is thrown upon the subject, it may not be improper to consider these collections of matter as the result of chronic inflammation.

To some, the subjects which have now been discussed may appear too indefinite and obscure to be legitimate objects of investigation, particularly in an elementary work. To this I would reply in the energetic language of Bichat 'that, in explaining the animal economy, it is doing much to indicate analogies; to show the uniformity of an unknown phenomenon with another about which all the world are agreed. In every branch of science,' adds this author, 'it would be well if the principle were thoroughly appreciated, that nature, greedy of her means, is prodigal of results; that a small number of causes every where preside over a multitude of effects, and the greater part of those about which we are doubtful are referrible to the same principle with others which appear to us evident.'

The treatment of chronic inflammation is very little understood. It is often said that parts which have been much weakened, especially by large bleedings during the acute stage, are liable to fall afterwards into the state of chronic inflammation. We believe, however, that the remark is

not of general application; and that this form of the disease is oftener attributable to a neglect of those vigorous measures which would have cut short the acute state of inflammation at its commencement. Chronic inflammation is almost as much out of the control of medicine as acute inflammation is under it. Nature sometimes works a cure; but in many cases, more particularly of primary chronic inflammation, the prognosis is very unfavorable.

The general system of treatment must depend upon the state of the constitution. Four plans of treatment have been advised, and each has been found serviceable under different circumstances.

1. Where fever is present, blood-letting, purging, and saline medicines, with a low diet, are to be recommended.

2. Where the pulse is feeble, and there is a decided loss of tone in the system, myrrh, benzoin, the balsam of copaiba, steel, and bark, are unquestionably useful.

3. Where the disease is purely local it is best treated by leeches, blisters, and issues, upon the principle of counter irritation.

4. Where these means fail an alterative plan of treatment may be resorted to. This is done under the idea of giving a new action to the vessels. Upon this principle mercury is employed in the treatment of chronic hepatitis, alkalies in the scrofulous inflammation of absorbent glands, and sarsaparilla and guaiacum in chronic rheumatism.

We are now called upon to follow the nosological order of inflammatory affections, and the first which falls before us for notice is,

345. *Ophthalmia*, or inflammation of the eye. The species of the genus are, it will be seen, ophthalmia membranosa, inflammation of the membranes of the organ; and ophthalmia tarsi, inflammation of the eye-lids.

The eye is a complicated organ, and therefore subject to a variety and complication of ailment, and Dr. Cullen's divisions are by far too general and superficial; most, however, of the minute circumstances and incidents attendant upon ophthalmic irritation will come to be considered under the head of SURGERY, and we shall here limit ourselves to a very cursory notice of the inflammatory disorders which occasionally attack the organ of vision.

The principal points of attack are the tunica conjunctiva, the sclerotica, the iris, and the tarsal glands. Pain, inordinate sensibility to the light, a feeling as if something gritty had made its lodgment in the eye, redness in the parts which are usually colorless, and an increased flow of tears, are the prominent symptoms of conjunctival inflammation. When the disorder is very severe, head-ache, and often of an excruciating kind, accompanies the inflammation; the intolerance of light is extreme, and the inflamed conjunctiva extends to the lids, occasions them to swell, and to pour out a purulent secretion which glues the edges of the lids together; and then the purulent ophthalmia of authors comes to be formed, which, if suffered to run on without interruption, tends to a disorganisation of one or other of the structures of the organ, one of the most common and direct of which is the inflammation extending over the cornea, and, by thickening its coats, destroying its transparency, and of course in the degree of the opacity produced does vision become defective; sometimes, in place of chronic thickening and opacity, actual and open ulceration is formed in the cornea. The iris sometimes partakes of the disordered action, and adhesions are hence formed with the capsule of the lens, or with the posterior layer of the cornea, and more or less of blindness is thus induced. In weak and scrofulous habits the acute state of ophthalmia, instead either of completely yielding or terminating by one or other of these disorganising processes, passes into an indolent or chronic state of conjunctival inflammation, and continues for some time in a very obstinate way, refusing to yield to ordinary treatment.

The causes of ophthalmia are those which either operate upon the organ itself immediately or from without, or those which act sympathetically or intermediately; these are frequently combined in their operation, that is, the external irritants which produce the disease would not sometimes prove of sufficient force, were they not assisted in their influence by the condition of the general system. A pecular poison sometimes seems to engender ophthalmia, as was the case with the Egyptian army; a poison which seems to affect both endemically and epidemically; thus it appears to result from the combined influence of heat and moisture and floating particles of sand in the atmosphere acting in combination with the predisposing circumstances of fatigue and bad living, and having once affected becomes communicable from one individual to another; there does not appear to be any room for doubting that disordered states of the eyes were communicated from our soldiers who returned from Egypt ophthalmically affected, to many of the inhabitants even of this country; in which, of course, the endemic circumstances which had to do in the formation of the disease originally could not have operated.

The ordinary external irritants are changes of temperature, exposure to a brisk and keen wind; blows, and other mechanical or chemical irritants. The internal sources of the disorder are generally deranged states of the digestive organs, produced by intemperance, or occurring more spontaneously, and the presence of some morbid poison as of small pox; translated poison, also, or metastatic action, is to be put down as one of the sources of ophthalmia, manifested in the curious instance of the gonorrhæal discharge ceasing or becoming repelled from its common locality, the urethra, and affecting the eye; in this case the purulent ophthalmia becomes formed, and, although it is not the same matter which is engendered by the new disease with that which has ceased to flow from the urethra, the subsidence of one disorder and the immediate commencement of the other are curious facts in pathology. It has been found that the matter of gonorrhœa, when the disorder is very active and the discharge acrimonious, if applied to the eye will sometimes excite inflammation; and it has

been supposed that in the instances of ophthalmia after gonorrhœa some accidental application of this kind had taken place; but there does not seem evidence sufficient to establish this presumption, and the vicarious manner in which the eye affection occurs is inconsistent with the hypothesis.

The kind of disease to which Dr. Cullen applied the term tarsal is of scrofulous origin, and is very commonly seen in children of a strumous habit. With tarsal inflammation, which extends to the glands and occasions a copious secretion of matter, which glues the lids together, you often see marks of membranous irritation, which in some cases indeed is very severe, accompanied with an increased flow of tears and all the other symptoms and tendencies of membranous ophthalmia; so that the distinction is often an untenable one. Occasionally, however, a chronic, and indolent, and evidently a scrofulous, affection of the tarsi will be present for a length of time without being extended to the actual structure of the eye. There is scarcely a stronger indication of scrofulous diathesis than the condition of eye-lid to which we are now alluding.

The venereal poison, when it affects the eye in a secondary way, most frequently attacks the iris. Iritis, however, will be most properly considered in the article SURGERY, and so will that species of inflammatory irritation which has but of late years been duly recognised as one of the producing causes of amaurosis, which occurs frequently, as a consequence of the intemperate use of the eyes, and in which there is often impatience of light and even an increased secretion of tears without any exterior redness of the organ.

In the treatment of ophthalmia depleting measures will be called for, according to the degree of the disorder, and the condition of the constitution. In violent cases general bleeding, and that copiously, is often demanded. In the milder cases local abstractions of blood, as by leeches and cupping glasses, will be all that are required. In all cases the state of the stomach and bowels must be carefully attended to; for, as we have above intimated, the source of the disorder, or, to say the very least, the predisposition to it, is to be found in a deranged condition of the whole system. Where we are fearful of large detractions of blood, nauseating doses of tartar emetic will be found serviceable in getting under the inflammatory diathesis and the local disorder; and, after the bowels have been evacuated, the combination of calomel and opium, in the small doses of half a grain of each, repeated three or four times in the day, will often prove exceedingly beneficial. The counter irritation of blisters is almost always desirable after the force of the inflammation may be a little subdued by blood-letting, or where the disorder has not assumed a very formidable aspect from the first; and cold lotions, such as a scruple of the sugar of lead to half a pint of distilled water, will assist in the cure.

When inflammation of the eye has become chronic and indolent, tonics are often required, together with topical applications of a more astringent kind, such as the white vitriol (the sulphate of zinc), a scruple or half a drachm of which may be dissolved, for a lotion, in half a pint of water, or alum solutions, or aqueous or vinous solutions of opium, may be dropped into the eye. In these cases attention to visceral states is also absolutely necessary, as it is also in the strumous or tarsal affection to which we have above alluded, and for which the best local application is unquestionably the citrine ointment, the unguentum hydrargyri nitratis, with which the lid should be penciled every night, after the subject of the disorder has gone to rest, and closed the eyes; for, if used while the eye is open, it may stimulate the membranous part of the eye too much, and cause a painful irritation.

346. *Phrenitis.*—Inflammation of the brain. The acute or violent kind of phrenitis in an unmixed form is not of very frequent occurrence, although inflammatory affections of the brain of a less decided character, and less formidable aspect, are not by any means infrequent. Indeed disorders which go under other names, such as apoplexy, epilepsy, paralysis, and hydrocephalus, are often but certain modifications of brain inflammation, and this inflammation is, as we have already seen, a very usual accompaniment of fever.

The following are the characterising symptoms of acute or idiopathic phrenitis. Acute pain, which often begins at the back or hinder part of the head, and at length extends over the whole of the head, flushed face, eyes red and prominent, intolerance of light and sound, the carotid arteries appearing to beat with unnatural energy, furious delirium, the pulse for the most part very quick and hard, and the tongue furred. When the symptoms are more insidious, and the disease is more symptomatic of other derangements, the symptoms for the most part are such as characterise a typhoid disposition.

Causes of phrenitis.—Exposure to the rays of a vertical sun, especially in the tropical climates, will produce inflammation of the brain, at times in an immediate manner. This constitutes the insolation, or coup de soleil, of authors; violent passions of the mind, immoderate application to business or study, external violence, as from blows or falls, repelled eruptions, extension or translations of external erysipelas upon the brain, inebriation, and a disordered state of the first passages or viscera; which last sometimes merely predisposes to, at others actually excites the complaint.

Distinctions.—Some persons have confounded phrenitis with mania, or at least have supposed that, where maniacal excitement manifests itself to a very considerable degree, there must necessarily be inflammation of the brain; there appears, however, to be considerable error in this opinion, and it is an error which may lead to false inference with respect to practice. Phrenitis, we are told, may be distinguished from insanity by the former being necessarily attended with pyrexia, and by its being externally imprinted on the countenance in a way more indicative of vascular fulness. The pulse too is harder and more frequent than is ordinarily the case in mania. From the inflammation of fever

it is to be distinguished by its early manifestation, or by its being synchronous with the general derangement, while the phrenitic symptoms of fever present themselves after the disorder has existed for some time. The powers too in phrenitis are not in that oppressed state that they are in fever.

There is a singular condition of brain, for the most part induced by a long course of inebriation, which, although manifested by a certain kind of high excitation, is still different from phrenitis: the condition of the brain to which we now allude is named in the schools delirium tremens, from the circumstance that, while encephalic excitement is at a very high pitch, there is a trembling and powerless condition of the general system, differing on the one hand from the oppression of fever, and on the other from the excitement of real or high inflammation. It ought always to be the aim of the medical practitioner to recognise these distinct conditions, both of the brain and general system, and not to confound all manifestations of cerebral irritation under the general notion of inflammation.

The student, it has been further remarked, must not expect to find every case of phrenitic disorder marked with unequivocal signs, nor is it very easy sometimes to distinguish the idiopathic from the sympathetic phrenitis; the complaint, moreover, occasionally occurs in the most insidious manner, and if the difficulty of distinguishing abstract or idiopathic phrenitis, from the phrenitis consequent upon fever, should embarrass the young practitioner, let him recollect that this difficulty is not peculiar to the inexperienced; indeed some, as we have already had occasion to intimate, maintain, that no such distinction actually exists. There appears, however, to be one state of brain in fever, another in phrenitis, another in mania, and another in delirium tremens, although the lines of demarcation are not always to be traced: disordered conditions being often mixed and modified to an extent which defies systematic recognition.

Some practitioners have dwelt much on the variations of external symptoms, from the circumstance of the membranes, or the substance of the brain, being in one case or another especially implicated; the membranous inflammation giving you marks of very high excitement, while the affection, falling upon the actual body or substance of the brain, presents features rather of a typhoid kind; and there appears some foundation for this alleged distinction, although, even in reference to this particular, we must not presume too largely upon our power of determining interior conditions by external signs.

Prognosis.—We may expect phrenitis to terminate favorably if the symptoms are soon mitigated by the treatment. The occurrence of any spontaneous discharge is a good indication; such as warm and free perspiration; natural and pretty copious diarrhœa; a considerable flow of urine, which shall soon throw down a considerable sediment; bleeding at the nose is also a good sign, when the powers are not much exhausted; a return of consciousness and tranquillity is of course a favorable symptom.

If the pulse continue hard and rapid, and the watchfulness and delirium do not subside, or if stupor succeed with dilated pupils, and subsultus tendinum occur, the prognosis will be unfavorable. Should the secretions and excretions continue to be small in quantity, or irregularly produced, and the fœces wanting in their proper color and consistence, we shall have to judge unfavorably. A total suppression of urine is a mark of much danger, and in this, as in some other disorders, is often a prelude to death.

Treatment.—In the management of very high and unequivocal affections of the brain of an inflammatory kind, it is often proper and necessary to draw blood very profusely; and the disorder will refuse to yield till you are successful in making a very considerable impression upon the system. In other cases, of a less marked and idiopathic character, the taking of ten or twelve ounces of blood will prove a better practice than that of ad deliquium depletion. If the practitioner be dexterous at these operations, the opening of the temporal artery, or the jugular vein, will often prove more advantageous than the common mode of taking blood from the arm; should this last be preferred, a large orifice ought to be made, and the quantity abstracted in a short space of time, especially in cases where we are desirous of producing faintness.

Elaterium, as a purgative, is often very useful in cerebral disorders, as it makes an impression on the system somewhat similar to large blood-lettings. In the course of the disease the saline purgatives, combined with diuretics, may be employed. See under *Fever*.

The foxglove is a favorite remedy with some practitioners in doses of from fifteen to twenty minims, several times in the course of the day. 'I have given,' says the late Dr. Currie, 'digitalis in inflammation of the heart, and the lungs, and the brain, and have succeeded with it in cases where I should otherwise have despaired.'

After the vessels have been freely depleted, and the inflammatory symptoms somewhat subdued, let the diaphoretics that are given partake a little more of the stimulant character.

℞ Liquoris ammoniæ acetatis f. ʒiij.
Ammoniæ subcarbonatis gr. vj.
Syrupi croci f. ʒij.
Aquæ puræ f. ℥iss.
Fiat haustus.

Take of liquor of acetated ammonia three fluid drachms, subcarbonate of ammonia six grains, syrup of saffron two fluid drachms, water a fluid ounce and a half. Mix into a draught.

Let ten or twelve leeches be applied to the head, and after venæsection let a large blister be put upon the nape of the neck, or to the legs. Let the head be kept rather high; if it can be done without producing much irritation, let the hair be all taken off with a razor, and to the naked scalp apply either cold iced water in bladders, or spirits and water, or an evaporating lotion composed of seven ounces of liquor of acetated ammonia and one ounce of sulphuric ether, or a drachm or two of muriate of ammonia with on ounce and a half of rectified spirit of wine ana six ounces and a half of water. Throughout the whole course of the complaint it will be found

of the utmost importance to keep the apartment in which the patient lies dark and cool, to forbid the intrusion of visitors, and to countermand all animal food excepting some broth, which may be sometimes serviceable, given under the collapse that has been produced by the necessary severity of the remedial processes.

In conclusion, says the author from whom we have extracted the last paragraph, I wish again to remark that phrenitis, or at least inflammatory disorder of the brain, will oftentimes present itself under less characters of decision; will be mixed up with other complaints; and will prove the gradual result of erroneous or obstructed action in other and distant parts. In these cases the treatment will require to be assiduously directed to these primary and constitutional conditions. On the other hand it is to be recollected that these supposed primary are not seldom actually secondary states, and that a bad condition of the encephalon will produce disordered viscera with as much or more readiness than disordered viscera will bring on brain affection.

In the treatment of delirium tremens opium is our sheet anchor; it is impossible to lay down any directions for its dose of undeviating application; but two or three grains of the powder of opium, combined with some liquor of acetated ammonia, are often necessary. The bowels must at the same time be attended to, and sometimes, previously to the administration of a full dose of opium, it may be proper to abstract some blood notwithstanding the prevailing debility. The compound powder of ipecacuan is a good form of administering opium in many brain affections where we are desirous of allaying irritation, but are fearful of opium by itself in substance or tincture. The vegetable acids too are useful adjuncts of opium, when we have to administer it in cerebral disorder. From six to ten grains of the citric acid dissolved in an ounce and a half of water, will form a good vehicle for small and repeated doses of tincture of opium, when these are required in phrenitic irritations.

347. *Cynanchial disorders.*—In the genus cynanche Dr. Cullen includes the cynanche tonsillaris, or inflammatory sore throat; the cynanche maligna, or malignant sore throat; the cynanche trachealis, or croup; cynanche pharyngea, or inflammation of the pharynx; and cynanche parotidea, or mumps; each of which demands separate consideration.

348. *Inflammatory sore throat* is an affection of the mucous membrane lining the fauces, and especially of the tonsil glands, sometimes extending down the pharynx, at others spreading about the lining membrane of the nose, and producing a suffocating sensation and difficult breathing; but the inflammation and swelling of the tonsils are the main characteristics of the disorder now under notice, and this inflammation is sometimes so high, and the consequent tumefaction so great, as to impede deglutition, and even materially to interfere with the respiratory process. When the inflammation takes its course towards the orifice of the eustachian tube a temporary deafness will be attendant upon quinsey. The fever which accompanies the local affection is either synochal or synochous, according to the constitutional condition of the patient and the extent of topical disorder. There is generally a teazing and irritating increase of saliva in these affections, which is more observable and troublesome on account of the difficulty of swallowing; the cheeks are often swollen, the eyes red, and the patient very irritable and distressed.

Causes.—Those of inflammation generally; and especially an exposure to sudden changes from heat to cold and from cold to heat. Its occurrence is principally late in the winter, or early in the spring; it is exceedingly liable to recur from a slight exciting cause, the system having once been affected by it.

Distinctions.—The inflammatory quinsey is distinguishable from the malignant sore throat by its being more of a phlegmonic than an erythematic inflammation, and by its tendency to full and complete suppuration rather than to the formation of small separate ulcers. The fever too is for the most part without those typhoid characters which denote the malignant species.

Prognosis.—The termination is usually favorable, and within a few days of its occurrence. There have been instances of suffocation being produced by the enlargement of the glands during the suppurative process; but this is an exceedingly rare event, nature for the most part effecting the discharge, or if not the lancet may be plunged into the suppurating tumor, and thus the threatened occurrence averted. When the prognosis is to be unfavorable the disorder passes into the erysipetalous and malignant kind.

Treatment.—If the patient be of a full plethoric habit, and the inflammatory excitement considerable, venæsection should be had recourse to; but for the most part we should say it is not requisite. A scarification of the tonsils often gives considerable relief. Emetics may be administered at the onset, composed of half a grain of tartrate of antimony, and two or three drachms of wine of ipecacuan. When leeches are employed, they are best placed two or three under the lobe of each ear. Saline diaphoretics and purgatives may be employed according to circumstances (see under *Fever*); blisters put to the back of the neck, not to the throat; and, the inflammation having been got a little under, the following gargle may be frequently used:—

℞ Acidi muriatici f. ʒß.
Syrupi papaveris f. ℥ij.
Infusi rosæ f. ℥vj.
Fiat gargarisma.

Take of muriatic acid half a fluid drachm, syrup of white poppy two fluid ounces, infusion of roses six fluid ounces. Mix for a gargle.

Emollient poultices, made of bread and milk or linseed meal, may be applied to the sides of the neck for the purpose of assisting the suppurative process; and the inhalation of warm water from Mudge's instrument (into which some tincture of opium is put—about an ounce of the tincture to half a pint of the water), may prove serviceable in allaying irritation.

Small doses of sulphate of quinin, or a draught or two in the day of decoction of bark, with ten or fifteen minims of the diluted sulphuric acid, may assist convalescence, especially when the

onsil affection, instead of entirely subsiding, falls into a sort of indolent state.

The second species of the cynanche, the cynanche maligna of Cullen, will fall to be considered under the head of scarlatina among the exanthemata.

349. *Croup*.—This disorder is characterised by a sonorous inspiration of a very peculiar kind; it comes on sometimes suddenly, and at other times is preceded by common catarrhal irritation, which lasts for days; when it is established the difficulty of breathing is very distressing. The attendant cough is usually hard and dry at first, but afterwards a viscid matter is secreted, and the efforts to expectorate it threaten suffocation. The disorder sometimes terminates life in less than eight-and-forty hours from the attack; at other times it runs on to the fourth or fifth day, and may then terminate fatally. Croup is a disorder of childhood, generally occurring before the third year, but sometimes it takes place when the child is nine or ten years old. It is apt to recur.

There seems some difficulty in accounting for the disorder being confined to childhood; but this is the fact; and it has been explained by some on the supposition of the mucous lining of the wind-pipe, which is the seat of the disorder, undergoing some change of susceptibility.

Death from croup is usually produced by the rapid formation of an adventitious membrane or tube of coagulable lymph, which in many cases extends down into the ramifications of the bronchiæ; there is at the same time often a muco-purulent secretion which assists to plug up the passage and impede the breathing, and the spasm which the violence of the inflammation brings upon the muscles about the glottis often contributes to the fatal termination.

Causes.—Croup is produced by the common excitants of inflammation in children predisposed to the disease, the predisposition consisting in a full habit with robust stamina, or in a particular susceptibility about the respiratory organs. Teething seems often to excite croup. A disordered state of the stomach and bowels may excite the disorder, and very generally predisposes to it. Some peculiarity in the atmosphere at times tends to induce it, for it occasionally proves endemic and epidemic. It has, as we have intimated above, a tendency to return by habit. In some cases it would seem to be contagious.

Distinctions.—Croup is distinguished from other disorders of the wind-pipe and lungs by the peculiar stridulous breathing; it has intermissions and exacerbations like spasmodic asthma, but the intervals are not so free from disorder as in the latter case, and the attendant irritation is more decidedly febrile.

Prognosis.—Croup is proverbially a dangerous disease. We may, however, expect a favorable termination when the expectoration shortly becomes free and relieves the little sufferer. When no expectoration takes place, and the voice increases in acuteness, without the irritative fever declining, we must expect an unfortunate termination.

Treatment.—Promptitude and decision are here necessary. If the practitioner be called in before the disease has fully established itself, an emetic of ipecacuan may be administered with the addition of some emetic tartar.

℞ Vini ipecacuanhæ ℥ß.
Antimonii tartariz. gr. i.
Aquæ puræ ℥ß.

Fiat mistura, sumat coch. min. subinde donec excitetur vomitio.

Take of ipecacuan wine half a fluid ounce, tartarized antimony a grain, water half a fluid ounce. Make them into a mixture, of which let the child take a tea-spoonful from time to time till vomiting is excited.

When the disease is fully established, the calomel treatment will be found the most efficacious, as this medicine possesses the power of breaking down the crasis of the blood, and thus preventing the formation of the adventitious membrane which, as we have above said, is formed of coagulable lymph.

℞ Hydrargyri submuriatis gr. ij.
Pulv. sacchari albi gr. iij.

Fiat pulvis, secundis horis sumendus.

Take of calomel two grains, white sugar powdered three grains. Make it into a powder, and administer it every two hours.

In cases of very high irritation, and much fulness, bleeding by leeches or opening the jugular vein may precede or accompany the calomel plan; but we must be careful not to carry the bleeding too far, lest we induce that spasmodic action which, as above intimated, tends to hasten suffocation.

Some practitioners are stated to be exceedingly successful in the employment of tartar emetic, so as to induce and keep up a constant nausea, till the force of the disease is broken.

An external application to the chest of the following ointment may be of much use by exciting vicarious irritation of the skin.

℞ Antimonii tartarizati ℈j.
Opii pp. pulv. ℈j.
Cerati cetacei ʒij.

Fiat ung. cujus applicetur thoraci pars sexta, viâ fricationis, sextâ quâque horâ.

Take of tartar emetic and opium of each a scruple, cetaceous ointment two drachms. Make an ointment, of which the sixth part is to be applied to the chest by friction every sixth hour.

Warm bathing may be used with advantage when the plethoric fulness and high action have been in some measure subdued by the bleeding, or calomel, or antimony.

Bronchotomy or laryngotomy has been proposed, and we have seen it had recourse to, but not with eventual success. The fact is, that the membrane of which we have spoken, for the most part, in fatal cases of croup extends down into the bronchiæ, and there is moreover such a loss of power locally and generally before the operation would be at all justifiable, that we cannot expect much from the expedient in question.

In all cases of croup, the probability of the inflammation recurring ought to be guarded against, and preventive measures had recourse to, such as an attention to the condition of the stomach and bowels, and care against repletion.

350. *Pharyngeal and laryngeal inflammation.*—There is a species of erythematic inflammation which occasionally affects the pharynx, which is attended with difficult deglutition, but not of impeded respiration, unless from the pharynx the inflammation extend itself into the larynx, and then the laryngitis of some authors comes to be formed, which is a disorder of much danger, and often proceeds with rapidity to a fatal termination.

This cynanche laryngea, or laryngitis, is attended with difficult respiration, with a sense of suffocation, and often a simultaneous difficulty of deglutition.

Distinctions.—Croup is different from an inflammation merely of the larynx in the circumstance of that stridulous or sonorous respiration, which we have above stated characterises the croupal inflammation; it occurs moreover in adult or advanced life, which is not the case with croup. From an actual affection of the lungs the laryngeal disorder is distinguished by a certain kind of hoarseness and impediment of respiration referred to the wind-pipe at its upper part. From asthma laryngitis is distinguished by its attendant fever, and by its being wanting in that complete intermission which characterises the latter ailment.

Causes.—Sudden alternations of heat and cold. Violent exercise of the voice. Irritations in the alimentary and intestinal canal, producing the disorder in a sympathetic way.

Prognosis.—Laryngeal inflammation is a disorder of much danger. It often appears very active and spreading, and unless checked shortly terminates existence. Sometimes suppuration is formed, a collection of matter is found in the sacculi laryngis, or an effusion of coagulable lymph terminates the disorder more in the way of croup.

Often a chronic inflammation establishes itself in the larynx, which is attended with a slow fever, that eventually takes on the hectic character, when the disorder from the state of mere inflammation shall have passed on to its ulcerative stage. Chronic laryngitis is also a disease of danger. This disorder, when it terminates fatally, is often confounded with phthisis, and in some cases a species of actual consumption is occasioned by the extension of the irritative action down into the lungs; but very often life is terminated by ulceration in the larynx without any accompanying disorder of the lungs.

Treatment.—When the larynx is affected with active inflammation, large bleedings are called for; after which, and it may be right to push the bleeding to the extent of producing fainting, blisters may be had recourse to; these, however, should not be applied immediately over the part affected, but upon the breast or neck. The ointment recommended under the head of croup, may likewise prove serviceable. Warm water from Mudge's inhaler may be employed with tincture of opium and ether: the latter is more especially proper when the disorder takes on somewhat of a spasmodic as well as inflammatory character. In the chronic laryngitis, calomel and opium in the quantities of half a grain of each, repeated three or four times a day, may be of service. Sarsaparilla decoction with Plummer's pill, the dose of the former being a quarter of a pint three times a day, of the latter five grains every night, may likewise be tried.

These laryngeal affections are often the consequences of syphilitic poison upon a scrofulous constitution.

351. *Mumps.*—Cynanche parotidea. After a slight febrile irritation a swelling occurs under the angle of the lower jaw, and extends upwards behind the ear, or forwards upon the submaxillary gland; the swelling increases gradually for three or four days, and then subsides. For the most part no treatment is demanded beyond a dose or two of some common aperient. Occasionally, however, the inflammation takes on a more decided and severe form, and terminates in suppuration. At other times delirium follows the retrocession of the swelling by a sort of metastasis to the brain; and now and then when the neck swelling disappears, the testes in the male and the breasts in the female become affected in the way of transference.

Causes.—Vicissitudes of temperature, or teething, or affections of the stomach and bowels, may be productive of mumps; but it seems for the most part either to be occasioned by a particular condition of the atmosphere, or communicated from one child to another in the way of a contagious disorder.

Treatment.—We have said above that it is for the most part scarcely necessary to interpose medicine, but, when the secondary or metastatic disorders of which we have spoken take place, these must be treated by antiphlogistic remedies, and local refrigerants or repellents, according to the measure of the new irritation. When there is much of swelling, without any very active inflammation, warm fomentations or emollient poultices will be required, together with the administration of purgatives.

Before we conclude the subject of mumps, it is right to say that the young practitioner must not expect to find every affection of the parotid and submaxillary glands marked by this regularity in respect of time, nor attended by these sequelæ. We frequently find disorders that may be entitled to the appellation of mumps, to assume very different appearances from those mentioned by systematic writers on these disorders.

352. *Pneumonic inflammation.*—Dr. Cullen divides this into peripneumony and pleurisy, the one a disorder of the substance and body of the lungs, the other of the investing membrane, the pleura.

The general symptoms of peripneumony, or inflammation of the lungs, are pain in some part of the thorax, or over the whole breast; this pain being rather obtuse; the pulse is quick and sometimes rather hard and wiry; a cough is present which increases the pain, and throughout the disorder the breathing is difficult. Expectoration is at first difficult and painful, but in the course of four or five days it becomes free and the breathing is much relieved; the pulse also becomes softer and less quick, and the symptoms of the disorder decline.

When the inflammation, instead of thus giving way, goes on to suppurate, rigors are felt, the

pulse becomes more bounding and does not decrease in frequency, the respiration also becomes more oppressed but not so painful, and the patient often cannot lie down excepting on one side, this side being that which is affected.

When pleurisy rather than peripneumony is the disorder, or when the pleura rather than the substance of the lungs is inflamed, the breathing is more tight and straitened as it were; if you ask the patient to breathe, he tells you he cannot without the effort giving him much pain; the pulse is harder, the attendant fever often higher, and from the first the pain is increased by turning from one side to the other.

In addition to pleuritic or peripneumonic inflammation, Dr. Cullen speaks of a bastard peripneumony, but which he scarcely admits as a distinct species. This affection, which is distinguished from the pleuritic inflammation and the inflammation of the substance of the lungs, is considered as implicating rather the mucous linings of the bronchiæ, and has been therefore described more recently under the title of *Bronchitis;* the symptoms of which are difficulty of breathing, with hoarseness and obstruction rather than painful or strictured feeling, the pyrexia not being so high as in the other kinds of pulmonic disorder; and the pulse, though quickened, being without the hardness or vibratory character of the pleuritic inflammation. Mucous expectoration is here also from the first considerable; indeed the condition is nothing more than catarrh, assuming a more than ordinary severity, and extending itself down more upon the mucous linings of the bronchial cells.

Another species of bastard peripneumony is constituted rather of a gorged or congested than positively inflammatory state of the pulmonary vessels, and is marked by suffocative rather than by painful breathing; the countenance too looks flushed, the lips are often bluish, and every thing denotes rather obstructed respiration than inflammatory excitement. Let the student, however, always be aware that these different degrees and localities and kinds of pulmonary affection run constantly into one another, so as to defy the precision of nosology, and let it be recollected that here, as in other cases, systematists are too apt to define and divide, and describe with a freedom beyond the warranty of truth.

There is, however, another particular which the student ought also to recollect, and which on the other hand is more in accordance with the principle of systematic division; it is that the pleura being a serous membrane, an inflammation of it shows different characteristics from an inflammation of the bronchial membrane which is a mucous tissue; a disordered state of the latter does not excite so much inflammatory commotion as one of the former, but it is for the most part of a more insidious cast, and proceeds to the suppurative termination more gradually and insensibly.

Causes of pneumonic inflammation.—Changes of temperature; violent exercise of the lungs, or of the body generally; suppressed or obstructed perspiration; a constipated state of bowel, which last is a very general circumstance of predisposition, and often an exciting cause of the complaint

Distinctions.—There is sometimes a difficulty in distinguishing between inflammation of the lungs and the liver; occasionally, indeed, both organs are engaged with the disease at the same time. The distinction, however, is to be taken from pressure upon the region of the liver not so manifestly increasing pain when the disease is pulmonary rather than hepatic; in pulmonary inflammation also there is the absence of that sallowness of countenance and oppression of spirits, which is so characteristic of disorder in the liver. In inflammation of the lungs, we have above observed, that expectoration after a few days becomes free, when the disorder is about to terminate favorably; this is not the case when the liver is the seat of the disorder. There is an absence too in pneumonia of the shoulder pain, which characterises, or at least often attends, inflammation of the liver. In pneumonia there is more or less cough from the first; but an inflammation of the liver may exist for some time without occasioning any cough, which is of course more sympathetic and incidental than direct and essential. One author has told us, and occasionally we have observed the same thing, that the blood which is drawn when the liver is inflamed has its buffed surface tinged with yellow, and that the serous part of the blood is also more of this color than in pulmonary inflammation; it must however be allowed that this condition of blood is not invariably characteristic of inflamed liver, and therefore it cannot be received as an absolutely pathognomic or diagnostic sign.

Pneumonia is distinguishable from muscular or spasmodic pain of the chest by the attendant pyrexia, by its being more decided and continued, and by the attendant cough and expectoration.

Prognosis.—Pulmonary inflammation may be expected to terminate favorably when mucous expectoration occurs freely within two or three days from the attack; and, if this expectorated matter is tinged with blood, no unfavorable inference should thence be drawn. Warm and general perspiration, a deposit of sediment in the urine, spontaneous discharges, as of blood, from the nostrils, or diarrhœa, are favorable circumstances.

The unfavorable indications are rigors, delirium, cold, and partial perspirations; a purple appearance of the countenance, or a collapse of feature with an increase in the difficulty of breathing, while the expectoration either ceases altogether, or instead of being thick mucus becomes purulent and vanishes.

Treatment.—Venæsection, and that, in individuals of a firm fibre and when the inflammation runs very high, to a considerable amount; from sixteen to twenty ounces may be taken, and repeated the following day or two in succession. But, if the inflammation is not so considerable, and the powers of the system not so great, smaller quantities of blood may be withdrawn, as from ten to twelve ounces, and after the irritation is in some measure quelled let a blister be applied over the chest. The bowels must be evacuated by saline purgatives, which may be preceded by a five grain pill of calomel, a medi-

cine especially called for, if there be reason to suspect hepatic as well as pulmonary affection, or if the bowels had been much constipated previously to the attack of the chest disorder. When the blood-vessels and the bowels have been thus evacuated let one grain of calomel and one of opium be given every sixth hour; or, in place of this, administer nauseating doses of tartarised antimony with opium or poppy, as in the following formula.

℞ Antimon. tartariz. gr. i.
Syrupi papav. f. ℥j.
Aquæ puræ f. ℥v.

Fiat mistura: sumat partem quartam quartis horis.

Take of tartarised antimony one grain, syrup of white poppy one fluid ounce, water five fluid ounces. Make them into a mixture, of which let a fourth part be taken every four hours.

Some practitioners are very fond of digitalis. We have already made a quotation from Dr. Currie, who says he has succeeded in some cases with digitalis in inflammation of the brain, the heart, and the lungs, in cases where he should otherwise have despaired.

℞ Tincturæ digitalis ♏ x.
Tincturæ hyoscyami ♏ xxv.
Liquoris ammoniæ acetatis f. ʒiij.
Syrupi simplicis f. ʒij.
Aquæ puræ f. ℥iß.

Fiat haustus: quartis horis sumendus.

Take of tincture of foxglove ten minims, of henbane twenty-five minims, of liquor of acetate of ammonia three fluid drachms, of simple syrup two fluid drachms, of water a fluid ounce and a half. Make into a draught, to be taken every four hours.

When the inflammatory action is evidently lessened, and a tendency is manifested towards expectoration, let expectorant medicines be combined with refrigerants, diaphoretics, and anodynes.

℞ Vini ipecacuanhæ ♏ xxv.
Syrupi papaveris f. ʒi.
Pulv. potassæ nitrat. ℈ß.
Syrupi tolutani f. ʒij.
Aquæ puræ f. ℥iß.

Fiat haustus.

Take of ipecacuan wine twenty-five minims, syrup of white poppy a fluid drachm, powdered nitre half a scruple, syrup of tolu two fluid drachms, water a fluid ounce and a half. Mix into a draught.

The class of medicines called expectorants are chiefly applicable when the affection has been principally on the bronchial membrane; and in equivocal or bastard peripneumony, when there is considerable tendency to sinking in the vital powers, the subcarbonate of ammonia may be administered in combination with expectorants.

℞ Ammoniæ subcarbonatis gr. vij.
Mucilag. acaciæ f. ʒiij.
Vini ipecacuanhæ, ♏ xv.
Tincturæ scillæ ♏ xij.
Syrupi papaveris f. ʒi.
Aquæ puræ f. ℥iß.

Fiat haustus.

Take of subcarbonate of ammonia seven grains, acacia mucilage three fluid drachms, ipecacuan wine fifteen minims, tincture of squills twelve minims, syrup of white poppy a fluid drachm, water a fluid ounce and a half. Make them into a draught.

Small doses of cascarilla may be usefully employed in convalescence, combined with expectorants. The cascarilla, indeed, possesses an expectorant as well as tonic quality.

℞ Oxymellis scillæ f. ʒj.
Syrupi papaveris f. ʒj.
Infusi cascarillæ f. ℥iß.

Fiat haustus.

Take of oxymel of squill and syrup of white poppy of each a fluid drachm, infusion of cascarilla a fluid ounce and a half. Make them into a draught.

The terminations of pulmonic inflammation are, into effusion, constituting one species of hydrothorax; into general suppuration, forming the empyema of authors; into partial and confined suppurations, especially where there have been tubercles; in this case what are called vomicæ are formed; or there may be a pouring out of a muco-purulent fluid, either into the cavities of the pleura, or into the cellular substance of the lungs; or the termination may be in a congested state of the pulmonary capillaries with an effusion of blood from them; or the layers of the pleura may either be made to adhere together, or the adhesion may be between the substance of the lungs on one side, or the sides of the chest on the other. Indeed pleuritic inflammation cannot exist for any length of time unsubdued without throwing out the coagulable lymph which occasions these adhesions, whence results that impediment to respiration and want of free play in the lungs which so commonly follow upon pleuritis, even when the disease has been considered to terminate favorably.

The symptoms of vomica and empyema are marked in the nosology. When matter is distinctly perceptible in the chest, tapping has been occasionally had recourse to; but, in the general way, both local and general disorders are too confirmed to admit of permanent or radical relief by this measure.

353. *Inflammation of the heart.* Carditis.—The peculiar symptoms of inflammation of the heart, or rather of the pericardium (for it is for the most part in this membrane that the affection is resident), are sharp pungent pains referred to the region of the heart, attended with a sinking suffocating sensation, and catches in the breathing which are very much increased by motion or exercise of any kind; there is also a particular jar in the pulse, with a violent beating often of the carotids, and the whole of the patient's feelings are much more distressing and oppressive than in merely pleuritic disorder: the countenance as well as symptoms bearing marks of a vital organ being affected.

If the violence of the disorder somewhat subsides, but the inflammation does not entirely give way, a chronic affection of the pericardium is induced, and palpitations, continued dyspnœa, disturbed dreams, vibrating pulse, difficulty in

making any exertion, particularly in ascending a hill, œdema of the extremities, and eventually dropsy, occur.

Very little need be added, in regard to the treatment, to what has been advanced under the general head of pneumonia, only that the measures must be prompt and decisive, and we must not be deterred from the use of the lancet by the sinking sensations of the patient, if we feel pretty well convinced by other symptoms that the heart is in a state of active inflammation.

When the disorder has either fallen into a chronic from an acute state, or has been from the first of a chronic kind, the treatment is of course required to be different. Very small doses of digitalis may be employed in conjunction with calomel and opium as in the following formula, and great care must be taken to keep down irritation by avoiding all inordinate excitement either of mind or body, by avoiding full or stimulating diet, and preserving the intestinal evacuations free.

℞ Opii pp pulv. gr. ß.
Pulv. digitalis gr. i.
Hydrarg. submuriat. gr. ¼.
Mucilag. acaciæ, q. s.
Fiat pil. nocte maneque vel ter in die sumenda.

Take of opium in powder half a grain, powder of foxglove one grain, calomel a quarter of a grain, mucilage enough to make into a pill—take one night and morning, or three times a day.

Ointment externally applied to the chest, as in the following formula, may be useful in these chronic affections of the heart.

℞ Antimonii tart.
Opii pp pulv. āā ʒß.
Cerat. cetacei ʒij.
Fiat Ung., pars sexta app. om. nocte thoraci.

Take of tartarised antimony, and powdered opium, of each half a drachm, cetaceous ointment two drachms. Make them into an ointment, of which apply a sixth part over the chest in the way of friction every night.

When treating on the subject of rheumatism we shall have to revert to inflammatory affections of the heart.

354. *Peritonæal inflammation.*—Under the head of visceral affection we shall have immediately to treat of peritonæal inflammation, for when a disorder is called inflammation of the bowels or of the liver, it is very often only the peritonæal investment of the viscus that is much affected; sometimes, however, a great portion of the peritonæal membrane becomes the subject of inflammation, bringing with it a corresponding pain and fever without the immediate indication of any other visceral disease. Than pure peritonitis there is indeed scarcely any affection more common or more important for the physician to recognise. Its treatment when it is of the active kind is the same as that of active inflammation generally; and when of a more passive, insidious, or chronic nature, small doses of calomel, opium, and foxglove, as in the formula above for chronic inflammations of the heart, may be administered. The great object of the practitioner, in peritonæal inflammation, will be to prevent effusion into the abdominal cavity, dropsy of the abdomen when the inflammation is of a more spreading or erythematic kind, and adhesive union of a preternatural kind when the inflammation is rather phlegmonic than erythematic.

355. *Inflammation of the stomach.* Gastritis.—This disorder is not of very frequent occurrence; when it does take place it is for the most part in the mucous coat of the organ, and has been induced by the habit of intoxication, or by taking some poisonous material into the stomach, or occasioned by a specific disorder, as of schirrus affecting this part.

The symptoms of gastric inflammation when it does occur in an active form are an acute pain and sense of heat in the region of the stomach, the organ not bearing the mildest ingesta; there is a remarkable depression of strength, extreme anxiety depicted in the features, and sometimes delirium.

Causes.—Acrid or indigestible substances received into the stomach, alternations of temperature, a large draught of cold water while the body is hot, suddenly repelled eruptions of the surface, and metastasis, especially of gout.

Distinctions.—The burning heat of the stomach and attendant fever distinguish the pain of gastritis from that of mere spasm; from enteritis the stomach inflammation is distinguished by the seat of the pain, and intolerance of any thing that is attempted to be administered by the stomach. Hiccough too occurs in gastritis more speedily than in enteritis.

Prognosis.—If, in the course of two or three days, the pain and sickness cease, while the pulse becomes more free and full, and diminishes in frequency, the urine depositing a sediment, and the bowels becoming spontaneously loose, a favorable termination may be looked for. The unfavorable symptoms are a continuance of disease for some days, the pulse not decreasing in frequency, and hiccough remaining in spite of the medicinal processes.

Treatment.—General blood-lettings, and the free application of leeches to the epigastric region; afterwards warm fomentation and a blister, the copious employment of mucilaginous diluents, such as linseed tea, good barley water, with acacia gum dissolved in it. Emollient anodyne clysters are likewise to be injected.

℞ Tincturæ opii f. ʒß
Mucilag. amyli.
Aquæ puræ āā f. ℥vj.
Fiat enema.

Take of tincture of opium half a fluid drachm, mucilage of starch and water of each six fluid ounces. Make them into an enema.

℞ Olei ricini f. ℥iij.
Decocti hordei f. ℥v.
Fiat enema.

Take of castor oil three fluid ounces, barley-water five fluid ounces. Mix for an enema.

A common saline draught may be administered with five or six drops of tincture of opium, or pills with a grain of calomel and a grain of opium.

That erythematic, and at the same time chronic inflammation, which is often produced by a long habit of intemperance, especially by the habitual

and inordinate employment of spirituous liquors, is for the most part best treated by very small doses of mercurials joined with vegetable narcotics; the pain and irritation of real schirrhus is also occasionally mitigated by these medicines.

℞ Pilulæ hydrarg.
Extract. hyoscyami
Extract. conii āā gr. ij.
Fiant pilulæ duæ, nocte maneque sumendæ.

Take of blue pill, extract of henbane, and extract of hemlock, of each two grains. Make them into two pills, to be taken night and morning, two at each dose.

Schirrosities of the stomach generally, it may be remarked, take place about the cardiac or the pyloric orifice; and when the former is the case the stomach pain is immediately excited by eating; when the latter, the pain is more felt an hour or two after the meal, or when the digested material is making its way through the pylorus into the duodenum.

356. *Inflammation of the bowels.* Enteritis.—This is as common a disease as the stomach inflammation is rare; it is marked by pain in the part affected, increased by pressure; by great prostration of power; by much restlessness; great anxiety of countenance; spontaneous nausea and vomiting; small, contracted, and frequent pulse; with obstinate costiveness For the most part the pain is referred to the point where the large intestines commence, it being here where the lodgment is, as it were, made in the cæcum, that the inflammation of enteritis usually commences.

Causes.—Costiveness, or neglected bowel, often proves the actually exciting cause of enteritis; at other times it merely predisposes the individual to be affected by other causes—such as atmospherical vicissitudes, exposure of the body to cold, getting wet in the feet, spasms and contractions in the bowels and hernia becoming strangulated.

Distinctions.—Enteritis is distinguishable from colic by the presence of pyrexia, and by the pain being increased upon pressure; from the pain of gall-stones passing, it is to be distinguished by the quickness of pulse (for very violent pain occasioned by the passage of biliary concretions will exist while the pulse shall be under 100 in the minute); from nephritis or inflammation of the kidney, or from a fit of gravel as it is called, enteritis is distinguished by its being generally higher up in the abdomen, by its being without any retraction of the testicle, by the obstinate costiveness, and great sensibility to pressure.

Prognosis.—If the costiveness soon yields, if the pain from being fixed and intense changes its seat and becomes more moderate; if the pulse changes from the small contracted feel that it had at first to more fullness and less frequency; if the restleness and anxiety abate; and if an equal, warm, and free perspiration, occur, we may hope for a favorable termination.

The unfavorable signs are sudden cessation of pain, with the prostration continuing, and the pulse increasing rather than diminishing in frequency; hiccups, cold extremities, clammy and partial perspirations, and a drummy tense condition of the abdomen.

Remarks.—Inflammation of the bowels varies greatly, both as to degree, kind, and locality. Sometimes the villous coat of the bowel will be affected with erythema, and a diarrhœa will be the consequence rather than costiveness (indeed, diarrhœa in a very great many cases acknowledges this condition of the bowels for its cause); at other times the inflammation will be confined to the peritonæal investment of the bowel, and then the external tenderness and pain upon pressure are greater, and the pyrexia is for the most part more considerable; the peritonæum being a serous membrane, and serous membrane inflammation, as stated under the head *Pulmonary Disorder*, being usually attended with higher symptomatic irritation than inflammations of mucous tissues. Sometimes the fine membranes interspersed among the muscular fibres will be rather the seat of the disease, and in this case there will be the tormina and twistings noticed in the definition.

Then, further, in respect of degree, there is the greatest variety; sometimes the practitioner will hardly be certain of absolute inflammation, while at other times the symptoms are so marked and unequivocal that he who runs may read.

The mode of termination will be found much regulated by the seat and sort of inflammation. Decidedly marked enteritis, unless checked, tends with frightful rapidity towards a fatal issue; while the more fixed but less violent disorder, eventually comes to produce small points of ulceration, and tabid wasting. In this as in all other cases, and as we have all along endeavoured to enforce, the student is rather to be directed in his pathology and practice by attentive observation and reflection for himself, than by the distinctions and divisions and niceties of nosology.

Treatment.—When we are sure that active inflammation is going on in the bowels, we can only expect to arrest it by prompt and large blood-letting; it is the practice of some, and in our opinion it is a very good practice, to give a considerable dose of opium (say three grains of the powder in the form of a pill), immediately upon blood having been withdrawn,—the objection that would occur against this practice is, that as costiveness is a prominent and formidable circumstance in enteritis, so it should seem fearful to administer a medicine, the general tendency of which is to occasion costiveness; but it must be recollected that the inflammation and consequent irritation are the most fearful features of the malady, and that while that inflammation is proceeding it will be but of small avail to procure evacuations; then again the very constipation is sometimes produced by those states which opium is calculated to relieve; viz. a constricted state of the intestinal fibres. An actual objection indeed lies against the administration of violent purgatives in the minds of some when the constipation is occasioned by an inflammatory condition of the parts, inasmuch as the action of catharsis is they say likely to increase the evil we are desirous to subdue. This last objection may, however, be felt with too much weight, and it is for the most part desirable to procure a free passage through the bowels, more especially when we suspect that the malady has been induced by retained fæces.

At any rate purgative enemata should be injected.

℞ Magnesiæ sulphat. ℥iss.
Ol. ricini f. ℥j.
Aquæ bullientis f. ℥x.
Fiat enema.

Take of Epsom salts one ounce and a half, castor oil one fluid ounce, boiling water ten fluid ounces. Make them into an enema.

The following form of purgative by the mouth is most likely to be retained.

℞ Hydrargyri submuriatis ℈j.
Extracti colocynth. comp. ʒj.
Fiant pilulæ xvj, quarum sumat æger duas secundâ quâque horâ donec soluta sit alvus.

Take of calomel a scruple, compound colocynth extract a drachm. Make them into sixteen pills, and let two be taken every second hour till the bowels are opened.

Apply leeches and warm fomentations to the bowels; rub the abdomen all over with castor oil; give pills after evacuations have been produced containing a grain of calomel and a grain of opium. Warm bath. The application to the rectum of three or four drops of croton oil made into a suppository with crumbs of bread will sometimes excite to a discharge of the bowels when enemata fail. In case of invincible sickness, with every mark of introsusception, from four to six ounces of running quicksilver may be poured into the stomach.

The above directions of course apply to the more formidable and virulent shapes of the disease. The less decided, more insidious, more chronic, more equivocal, or more specific inflammations demand a discriminating adaptation to varying circumstances; and here we again repeat that the young practitioner must not be disappointed if he finds in practice different features and circumstances from those delineated by the nosologist.

357. *Inflammation of the liver.* Hepatitis.—For the definition of this, as of other diseases, let the student turn to the nosology. In the case, indeed, of hepatitis, Cullen has almost stretched out his definition, particularly of the chronic kind, into a history.

The pain, it must be recollected, in liver affections, varies very much both in itself and in its sympathetic consequences, as one or other part of the liver may be affected; the state of the bowels is irregular; sometimes a diarrhœa will be produced by the increased secretion and undue acrimony of the bile; at other times the inflammation will arrest, or very nearly so, the secretion altogether; and then of course there are clay-colored fæces and sluggish bowels; a yellowish tinge in the eye is not at all uncommon in hepatitis; the urine is high colored, and the spirits are for the most part dull and oppressed; the pulse is sometimes intermittent in chronic hepatitis, stomach derangements become conspicuous, and there is often a tendency to œdematous swellings about the ancles.

Causes.—Those of inflammation generally, immoderate use of spirituous liquors, mental affections; which last are sometimes causes, and sometimes consequences, of liver disorder. Autumnal heats and colds give an acrimony to the bile; this cause is more especially conspicuous in some of the tropical situations where heat and moisture act in combination, or speedy alternation; indeed, heat seems to possess some specific influence upon the liver; and it has been remarked by Dr. Thomas, and quoted by Dr. Gregory, that the liver, in warm climates, seems to be the seat of disease nearly in the same proportion as the lungs are in Great Britain: liver affections are occasionally induced by the cessation of the menstrual flux, which, like mental affection, is sometimes source, and sometimes sequence; protracted, or ill treated intermittents, are the cause at times of hepatitis; sitting day after day in one position, so as to impede the free circulation through the liver, may come to produce an inflammatory or congestive affection of the organ; tight lacing of stays; sudden repulsion of cutaneous disorder, or of perspiration; constipated bowel; in a word, whatever disturbs or impedes the circulation through this important and complicated organ may produce a measure of hepatic inflammation.

Distinctions.—From pneumonic inflammation (see PNEUMONIA), from gastritis by the absence of that burning sensation which is occasioned in gastritis by any thing taken into the stomach; and by the strength not being so suddenly prostrated as in gastritis, and by the pulse not being so small or oppressed as in gastric and enteric inflammation. Gall-stones passing give rise to suspicion sometimes that the liver is inflamed; but the intensity of the pain does not produce that irritation of the pulse which is always the product of inflammatory derangement. On this distinction, it will be recollected, we have before remarked; and it is an important one for the young practitioner to keep in his recollection.

Prognosis.—Favorable when the pain and febrile symptoms subside; the complexion loses its sallowness, and spontaneous evacuations occur; when perspiration breaks out general and warm, when the urine throws down a sediment, or when local inflammation breaks out in any part of the body's surface.

Unfavorable when the pulse continues full and frequent, and rigors take place; the pain having somewhat remitted, and being followed by a feeling of fulness and throbbing; or in the more chronic, and in this country more common form, the organ becoming hard to the feel; the yellow tinge of the countenance continuing; and, at length, abdominal swelling and fluctuation presenting themselves.

Terminations.—Inflammation of the liver may end in suppuration, the pus pointing outwards, and being discharged externally; or it may make its way through the lungs; or may penetrate into the abdominal cavity; or may get into the ductus communis, and through this channel be discharged; or it may get into the intestinal canal, in consequence of adhesion taking place between the inflamed liver and contiguous bowel, and a communication being made in this direct manner. Schirrous hardness, with enlargement, is a very frequent consequence of inflammation in the liver; tubercles and tubera, of all forms and sizes, are found in its substance; extensive adhesions

take place with neighbouring viscera and parts; vesicular cysts and hydatids become developed; unnatural softness, with enlargement, sometimes takes place; calculous or ossified matter becomes impacted in its body; in fine, there is scarcely any modification of morbid structure that the liver does not occasionally display upon dissection; and that with such a capricious irregularity as often to defy any precision of inference from symptoms during life.

Treatment.—General and local blood-lettings are demanded according to the urgency of the symptoms. After evacuations of blood, blisters and cathartics, as in other inflammations, are called for. Mercurial cathartics are in general preferred in inflammation of the liver, even of the most active kind; there may be some reason, however, to suspect that this free and indiscriminate action of mercury may be grounded too much on the notion of specific action. We in general prefer the saline cathartics, and those which, acting more upon the bowels than the liver, divert the current of blood away from the vena portæ. After purging and bleeding, calomel and opium may be given, as in pleuritic and enteric inflammation. When suppuration manifests itself, and the matter appears to point externally, it should be encouraged by warm poultices and fomentations. Suppuration being fully established, bark, and a somewhat more generous diet, may take the place of the antiphlogistic and lowering measures.

When the disorder is of a more chronic and less active kind, which is for the most part the kind or form we meet with in this country, the treatment is to be of a more deobstruent character, such plans being instituted as in some measure emulge the biliary organ of its load, or excite it into new actions. Topical bleedings by leeches or cupping glasses, and even small general bleedings, will be found requisite even in these cases; and here we may administer, with much advantage, small doses of mercury, in conjunction with the vegetable narcotics; the former with a view to excite and absorb, the latter to abate irritation.

℞ Hydrargyri submuriatis gr. i.
Extract. conii.
Extract. hyoscyami āā grs. ij.
Fiat pil. nocte maneque sumenda.

Take of calomel one grain, extract of henbane and hemlock of each two grains. Make them into a pill to be taken night and morning.

Mercurial inunctions are occasionally of service, as in the following formula:—

℞ Unguenti hydrargyri fortioris ℈j.
Camphoræ grs. v.
Fiat unguentum; applicetur omni nocte vel alternis noctibus in regionem hepatis.

Take of the strong mercurial ointment a scruple, camphor five grains. Make them into an ointment, which may be rubbed upon the region of the liver every night or every other night.

Or the tartarised antimony ointment, a formula for which will be found under *Inflammation of the heart*, may be used every night.

The taraxacum will often be found a useful medicine in chronic affections of the liver; it may be given in combination with some saline aperient.

℞ Potassæ tart. ʒij.
Extract. taraxaci ℈j.
Tinct. rhei f.ʒj.
Aquæ menthæ s. f.℥iß.
Fiat haustus.

Take of soluble tartar two drachms, extract of dandelion one scruple, tincture of rhubarb one fluid drachm, mint-water a fluid ounce and a half. Mix for a draught.

It is often advantageous to administer those medicines which act upon the kidneys in a sort of vicarious manner.

℞ Juniperi baccarum ℥iv.
Aquæ bullientis Oj.
Fiat infusum.
℞ Liquoris hujus colatæ f.℥iß.
Extract taraxaci ℈j.
Spiritus ætheris nitrici f.ʒj
Fiat haustus, ter in die sumendus.

Take of juniper berries four ounces, boiling water a pint. Make an infusion; of which, when cold and strained, take a fluid ounce and a half, and mix it with a scruple of dandelion extract and a fluid drachm of nitric ether. Make them into a draught, which may be taken three times a day.

℞ Sodæ subcarbonatis exsic.
Saponis duri, āā ʒj.
Pulv. rhei ℈j.
Ol. juniperi ♏ xxv.
Mucilag. acaciæ q. s. Fiat massa, in pilulas xxx. dividenda; sumat tres nocte maneque.

Take dried subcarbonate of soda, and hard soap of each a drachm, powder of rhubarb a scruple, oil of juniper twenty-five minims, make them into a mass, which divide into thirty pills, three to be taken night and morning.

The dandelion may be administered in decoction ad libitum; as may also the infusion of juniper berries.

In chronic affections of the liver some practitioners are partial to nitric acid, which may be given according to the following formula:

℞ Acidi nitrici diluti ♏ x.
Syrupi simplicis f. ʒiij.
Aquæ puræ f. ℥iß.
Fiat haustus, ter in die sumendus

Take of diluted nitric acid ten minims, simple syrup three fluid drachms, water a fluid ounce and a half. Make them into a draught, which may be taken three times a day.

The internal and external employment of chlorine has been recommended in hepatic and bilious affections. In its external use the aqua regia bath is formed; the following account of which is extracted from Dr. Mason Good's Study of Medicine.

'The aqua regia should be compounded of three parts in measure of muriatic acid, and two of nitric acid; and, in preparing them for use, a pint of the combined acid is to be mixed with the same measure of water. This constitutes the diluted acid or diluted aqua regia. The acid bath is to consist of three ounces of this

diluted acid to every gallon of water. It should, however, be observed by those who are inclined to form this mixture extemporaneously at their own houses, that if either of the acids be poured immediately upon the other, a large volume of very offensive gas will be disengaged, on which account it will be better to pour them separately and slowly on their proper measure of water.

'If the acids be of adequate strength, the mixture subdiluted for bathing, will, to the taste, have the sourness of vinegar, and perhaps prick the skin slightly if very delicate, but not otherwise after it has been applied to the skin half an hour. But since these acids vary much in their degree of concentration, as distilled by different chemists, there will be some variation in their power. The strength of the bath, however, should not be much greater at any time than the proportion here laid down; for otherwise it may excite a troublesome rash, and give a yellow hue to the nails and skin on the feet, or whatever other part is exposed to its action. A narrow tub for a knee bath, just wide enough to hold the feet, and reach the knees, should contain three gallons of the prepared bath liquor, and consequently about nine ounces in measure of the diluted aqua regia. For a foot bath, half a gallon may be sufficient, and a common washhand basin may be employed as a vessel for the purpose. The feet should remain in the bath for twenty minutes or half an hour; and the legs, thighs, and abdomen be in the mean time frequently sponged with the same. In the winter the water may be used warm; but this is not necessary in the summer. The bath may be employed at first daily for a fortnight or three weeks, and afterwards every other day, or only twice a week.'

358. *Inflammation of the spleen.* Splenitis. —We have already said that visceral inflammation may be mere peritonitis, when the peritoneal covering of the viscus is the part implicated with the disorder. It has likewise been intimated that a sort of gorged condition of the blood-vessels exists in some cases of visceral disorder that may approach to, but yet be under the grade of actual inflammation. Of splenitis as a peritonæal affection, we need add nothing more in the present place; but a measure and kind of splenitic affection often exists when it is not perhaps immediately suspected. When we have stomach irritations and derangements with vomiting of blood, with pains about the left shoulder, and general uneasiness, we ought to be upon our guard against disordered conditions of the spleen passing unnoticed.

Causes.—Those of visceral derangements generally. Protracted intermittents were formerly considered proverbially prolific of splenic enlargements; these are not now so common as formerly, partly perhaps on account of the comparative infrequency of the intermittents, and partly because in the treatment of them we are more careful to act upon the secretions and excretions than was formerly the case; for although the spleen does not appear to be an organ of secretion (see PHYSIOLOGY), yet its condition is much regulated by the state of other viscera that are secretory.

Distinctions.—Splenitis is perhaps most usually confounded with hepatitis when the disorder is chronic, and not unequivocally marked. The distinction is to be taken from the seat of the pain and enlargement, and from the presence or absence of bilious derangement, though there may be some deception in this last particular, since these viscera are connected together, partly in function, and partly in structure, as far as a connexion of nerves and blood-vessels may be said to unite them. From kidney affection, disorders of the spleen are more easily distinguished, inasmuch as the latter do not interfere so much with the urinary secretion, are confined to the left side, and are higher in their position than the kidney, and do not produce any retraction of the testicle.

Prognosis.—Mere chronic derangement of the spleen may last for years, and eventually be got under by judicious management. Even active inflammation of the organ does not tend so rapidly to disastrous consequences as the same measure of inflammation in some of the other viscera, partly perhaps because it is not subservient to chylopoietic functions as a secretory organ, and partly probably from the power the spleen may possess of working its own cure by spontaneous evacuations from its large and numerous blood-vessels.

Treatment.—Active and membranous inflammation must be treated upon the same principles as inflammation of other viscera affected in the same way; the chronic affections, to which it is subject, are best counteracted by an attention to the state of the bowels, by a mild and unirritating diet, and by the administration of deobstruents. See for a formula of mercury and anodynes under *Gastritis.*

359. *Inflammation of the kidney.* Nephritis. —We scarcely need add any thing to the definition given of this disorder in the nosology; we may say that although costiveness is not a pathognomic or necessary symptom, the bowels are often constipated, and that then the violence of the complaint is increased. Vomiting is not invariably an accompaniment of kidney affection, but there is almost always nausea; and when this condition of the stomach is present, without any obvious cause, we ought always to ascertain whether the kidneys, or in the female the womb, may not be disordered.

Causes.—Calculary concretions, violent exertions, as of riding, with strains or blows upon the loins, exposure to colds and heats, fæcal collections in the large intestines, acrid diuretics, as turpentine and cantharides, and metastasis, particularly of gout.

Distinctions.—Nephritis is to be distinguished from lumbago by the more fixed and less extended character of the pain; by its being increased on pressure upon the kidney; by retraction of the testicle; by the alteration in the quantity and quality of the urine; by the direction of the pain towards the groin, and down the thigh; and by the sickness of stomach. From enteritis by the pain being more behind than in front; by its not being accompanied by the obstinate constipation characteristic of enteritis; and by the pulse not being so rapid, oppressed, and small.

From gastritis by the sickness not being accompanied with the burning sensation at the stomach, especially when any thing is received into it. From gall-stones, or spasms upon the gall-ducts, by the seat of the pain, the absence of yellowness of the skin; by the urinary changes; and by the quickness of the pulse.

Prognosis.—For the most part favorable; the signs of approaching resolution, or on the other hand, the tendency to suppuration are marked, as in other inflammations. It may here be remarked, that purulent formation and discharge of pus with the urine may be the consequence of nephritis, and that this may continue for years without producing any great emaciation, any hectic fever, and without indeed much derangement of the patient's health. This fact, which is in opposition to the consequence of abscess in the liver, or some of the other viscera, has been accounted for by the kidney being an organ, as it is called, of waste, rather than of supply; that is, that its secretion is immediately discharged, and does not, as the secretion from the liver, &c., go to the assistance of alimentation. Nephritis sometimes ends in a destruction of the kidney's substance, but seldom is what would be properly called gangrene a consequence of kidney affection.

Treatment.—The inflammation must be met by the ordinary means of bleeding and purging. The purgatives should, however, be of the bland and unirritating kind; and, when saline cathartics are used, it is better perhaps to join them with manna. Castor oil is a good purgative in nephritic affections, especially when there is reason to suspect a lodgment of fæces in the colon, for the castor oil acts especially upon the larger intestines, and, as an oleaginous material, is more suited also to kidney irritation. Emollient and anodyne clysters, as ordered in enteritis, may be employed, and, when the pain is considerable, a drachm of tincture of opium may be added to them. Warm fomentations are always desirable; and the abdomen and region of the kidney may be rubbed over with castor oil. Drinks of linseed tea, or acacia mucilage, or barley water, or decoction of mallows, seem to have the power of blunting the irritation of the kidney; and, when nephritic irritation is caused by the presence of the lithic acid gravel, magnesia should be given pretty freely, either mixed with the drinks just mentioned, or administered alone with common water.

360. *Inflammation of the bladder.* Cystitis.—This is frequently marked by the same general symptoms as the kidney inflammation, only that the pain is lower down and in front upon the pubic region, and when the mucous or internal lining of the bladder is the seat of the affection mucous and muco-purulent, and sanious discharges are mixed with the urine: very often indeed affections of the prostate gland or membrane lining the internal surface of the urethra accompany the bladder affection, when this last is more of the chronic kind, and is seated rather in the mucous tissue than in the external surface of the organ.

Causes.—Local irritation as from calculus, extension of prostatic and urethral disease, blows upon the pubic region, and other common causes of inflammation.

Distinction.—The locality and consequence of the irritation, in general, will mark an irritation or inflammation of the bladder. The sympathetic irritations being those, a good deal of nephritis denotes that some portion of the urinary organs is affected.

Prognosis.—Active or external inflammation generally terminates favorably, if the proper remedies are timely had recourse to; but the mucous membrane affections are often tedious and obstinate, complicating themselves with affection of neighbouring parts, and sometimes giving rise to formidable, protracted, and structural disorder.

Treatment.—Acute inflammation of the bladder calls for the same treatment as nephritis, with the application of leeches to the pubic region, and warm anodyne fomentations over the lower part of the abdomen.

In the chronic affection the treatment demands variation from varying circumstances; when the irritation is present small doses of calomel and opium, as half a grain of each, two or three times a day, may accompany the castor oil and other bland purgatives which it may be necessary to administer; and when mere passive and habitual discharges have established themselves, a combination of copaiba balsam with one or other, or a mixture of two or three of the vegetable narcotics, may be employed with advantage.

℞ Extract. hyoscyami,
Extract. conii ā ā ℈j.
Copaibæ ʒiij.
Mucilag. acaciæ f. ʒvj.
Gradatim misceantur in mortario sensim affundens
Aquæ puræ f. ℥v.

Fiat mistura. Dosis cochlearia duo bis terve in die.

Take of extract of henbane and of hemlock of each a scruple, copaiba three fluid drachms, mucilage of acacia six fluid drachms. Mix them gradually in a mortar, gradually pouring on them five fluid ounces of water. Make them into a mixture, the dose of which is two table-spoonsful two or three times a day. Soap and soda may be given in combination with the narcotics. Emollient and anodyne injections, as of starch and opium, may often be injected into the bladder with much benefit.

361. *Inflammation of the womb.* Hysteritis.—In this disorder the spirits are for the most part depressed, and the pulse while it is small, is not perhaps, in the general way, quite so frequent nor so contracted as in the same measure of inflammation attacking other parts.

Causes.—Besides those of inflammation in general, as alternations of temperature, &c., the womb is liable to become inflamed by an interruption in the menstrual discharge, or in the lochia after parturition; a constipation of the lower bowel is also, by contiguity and sympathy, apt to affect the womb, and become an excitant of inflammation when the predisposition is strong.

Distinction.—From cystytis by the pain being deeper seated, and by the absence of the urinary changes.

Prognosis.—Peritonæal inflammation affecting the womb is often a highly dangerous disease, especially after parturition, when the powers have been exhausted by the process of delivery, and so much weakness and irritation are combined as to embarrass the practitioner with regard to the demands and admissibility of the case. When the inflammation is in the substance or body of the uterus, a gangrenous termination sometimes takes place, indicated by remission of the pain, prostration of power, hiccough, &c. If the peritonæal investment of the uterus is the seat of the affection, the unfavorable symptoms will be rather those of abdominal fulness and tension, with the pulse increasing instead of diminishing in frequency, and the supervention of rigors.

Treatment.—Blood-letting with more or less freedom and frequency according to the urgency of the symptoms and strength or weakness of the patient. In puerperal inflammation some practitioners abandon altogether the use of the lancet, and give calomel and opium; or even turpentine; but this form of the disease will be best discussed in the article MIDWIFERY. The treatment generally, both for the more acute and the more chronic kind, may be considered as properly analogous with that of cystitis.

362. *Rheumatism.* Rheumatismus. — *Symptoms.*—After exposure to cold or damp, lassitude and shivering occur, which sensations are followed by heat and pain of one or other of the large joints extending itself along the muscles; this pain is often as fugacious as it is violent. It remits in one part, and seizes suddenly and with equal force another; sometimes the surface assumes a redness, and there is for the most part swelling and a sense of tension in the joint or joints affected. The sympathetic fever that is excited often runs exceedingly high, but there is an absence of that hardness, and sometimes even celerity of pulsation, which characterises other inflammatory disorders; the tongue is white, the urine is high-colored, and there is often profuse perspiration. It is not only from joint to joint that rheumatism shifts; there is often a metastasis to the heart constituting one of the most formidable and dangerous species of carditis, to the muscles of the breast, and even to the pleura, diaphragm, and stomach. The bowels are often costive.

The chronic form of the disease is not attended by so much perturbation, but pains are experienced in the head, shoulders, knees, loins, and other parts, sometimes more fixed and sometimes more fugacious, leaving a paralytic debility in the parts affected, or tending to the induction of contracted limbs and stiffened joints. In either case, whether the disorder be acute or chronic, there is a disposition to be suddenly translated from one part to another; and another leading character of the malady is, that it does not incline to suppuration. The chronic is sometimes a sequela of acute rheumatism, at other times it takes place without having been preceded by the acute form of the disorder. In many cases after the complaint shall have fastened upon some one part particularly, and there lasted for a length of time, there will be a wasting of the muscular substance, and a consequent lessening in the bulk of the part.

Causes and peculiarities.—Cold, causing obstructed perspiration, damp air, wearing damp linen, or lying in damp beds; in fine every modification of cold, or transition of temperature, more especially when humidity accompanies this transition, will produce rheumatism.

There is some difficulty in respect of what systematic writers call the proximate cause of rheumatism, inasmuch as it is inflammation not only of a particular locality (this locality seeming, for the most part, to be the fine membraneous expansion which lines the muscles, or the tendinous aponeurosis), but the kind as well as seat is different from common inflammation; and it is moreover difficult to form an idea of that disorder being properly inflammation which shall in a moment's time leave the spot where it was raging violently, and be transferred with all its force, and at once, to another seat. There is one peculiarity of rheumatic inflammation, viz. that it does not tend to suppuration: this, indeed, we have already intimated, nor does it produce exudation quite in the way of erythematic, or rather erysipelatous, inflammation; in a word, it is a disorder (though often mixed up with others and thus greatly modified) in its nature, and essence, and characteristics, peculiar. The general division of this disorder is into acute and chronic as we have stated above. Some pathologists however, have proposed a third division into that of paralytic rheumatism; and there does seem some foundation for this adjective designation; for without any kind of affection that would imply inflammatory excitement, even of a specific or peculiar kind, the limbs are affected occasionally with a sense of coldness, and of a powerless condition, from causes which in other persons produce rheumatism, and which in several of their symptoms manifest an alliance with the more positive or legitimate shape of the malady.

Distinctions.—From gout rheumatism is distinguished by its affecting principally the larger joints, while gout is more common among the smaller; by its being for the most part more traceable to external excitants; and by its not being preceded by stomach ailments. Some indeed have endeavoured to prove that rheumatism is essentially a sympathetic affection, dependent upon gastric conditions. Yet, although no one will deny, who has been atttentive to the phenomena of disease, that pains of nearly a similar character to rheumatism are often consequent upon internal conditions, and gastric irregularities, he must be indeed wedded to system who maintains that rheumatism never establishes itself in the body, but through the medium of stomach irritation. Rheumatism further differs from gout in its attacking earlier in life, in its being attended when acute with more of sympathetic fever; while from common phlegmonous inflammation it is different in showing no disposition to suppurate, in changing from one part to another, and often by the redness and swelling being in no measure proportionate to the pain and irritation.

Prognosis.—Acute rheumatism requires often to be met by vigorous measures in the onset; and occasionally considerable blood-lettings would seem imperiously demanded; it is a fact, however, that blood-letting does not get hold of rheumatism quite in the same satisfactory manner that it does of common inflammation; and it is for the most part better to make a strong impression on the system by other means than detractions of blood. A pretty considerable dose of elaterium will sometimes serve to strangle a rheumatism in its birth.

℞ Extracti elaterii gr. i.
Confectionis aromat. q. s.
Fiat pilula.

Take of elaterium extract one grain; make it into a pill with a sufficient quantity of aromatic confection.

Colchicum too is exceedingly efficacious in the early stages of rheumatism; it may be given in the form of wine or the ammoniated spirit, according to the formula of Dr. Williams introduced into the last edition of the pharmacopœia, or in powder to the extent of five or six grains.

Sudorifics with digitalis may be employed when there is much of pyrexial irritation.

℞ Tincturæ digitalis purp. ♏ x.
Syrup papav. f. ʒij.
Liquoris ammon. acet. f. ℥ß.
Aquæ puræ f. ℥j.

Take of tincture of foxglove ten minims, syrup of white poppy two fluid drachms, liquor of acetate of ammonia half a fluid ounce, water one fluid ounce. Mix into a draught.

Saline purgatives also may be administered. Compound powder of ipecacuan, with very small doses of calomel, will often prove beneficial given at night.

℞ Pulv. ipecac. comp. grs. xij.
Hydrarg. submur. gr. ¼.
Fiat pulvis, horâ somni sumendus.

Take of compound ipecacuan powder twelve grains, calomel a quarter of a grain. Make them into a powder to be given at bed-time.

Or smaller doses of this very useful powder may be administered three or four times in the course of the day in conjunction with the liq. amm. acet.

℞ Pulv. ipecacuan. comp. grs. vi.
Liq. ammon. acet. ℥ß.
Aquæ puræ ℥iß.
Fiat haustus.

Take of compound powder of ipecacuan six grains, liquor of acetate of ammonia half a fluid ounce, water a fluid ounce and a half. Mix for a draught.

Calomel and opium, a grain of each made into a pill, will often prove beneficial in cases of obstinate rheumatic affection, after the high or pyrexial inflammation shall have in some degree subsided.

When rheumatism requires external application, we must be careful not to be too free with repellent, or cold, or saturnine lotions, lest we produce metastasis to internal parts. When these do take place, especially when the new residence is the pleura or the pericardium, or the heart, we must freely and fearlessly have recourse to blood-letting, and then follow it up by calomel and opium, to the extent of inducing a degree of salivation. Many lives, especially in the instance of heart metastasis, might be saved by this practice, sufficiently early had recourse to, and the practitioner ought always to be upon the alert against their occurrence.

Many years since the practice of giving the Peruvian bark very early and freely in acute rheumatism pretty generally obtained; it was administered even in the most inflammatory kinds and stages and with much reputed success. This practice, however, is at present almost entirely discontinued, and the bark is confined either to rheumatic disorders which ab origine manifest an intermittent or chronic disposition, or administered during convalescence, from the acute and more continued form of the malady. In intermittent rheumatism, if so any disorder may be characterised, the sulphate of quinin made into pills with crumb of bread, and given in doses of two grains two or three times a day, will occasionally prove of considerable service.

When, notwithstanding the continuance of the pyrexial irritation, there shall seem a tendency to sinking in the vital powers, ammonia will be found of much advantage; which, indeed, will sometimes check the disposition to metastasis. It may be given by supersaturating the common liq. am. acet. as in the following draught.

℞ Liq. ammon. acet. f. ʒiij.
Ammoniæ subcarb. grs. vij.
Syrup. papav. f. ʒij.
Mist. camphoræ f. ℥j.
Fiat haustus.

Take of the liquor of acetated ammonia three fluid drachms, subcarbonate of ammonia seven grains, syrup of white poppy two fluid drachms, camphor mixture one fluid ounce. Mix for a draught.

Treatment of chronic rheumatism.—The stimulant, warm, and tonic medicinals, are in this stage and state of the disease more unequivocally admissible; they may be combined or alternated with medicines that are usually called alteratives; and now it is that small and often repeated doses of the same medicinals may be had recourse to, which had in acute rheumatism been administered more largely, and for a shorter period.

℞ Guaiac. resinæ ʒij.
Pilulæ hydrarg. ʒj.
Pulv. digitalis ℈j.
Opii pp. pulv. ℈ß.
Mucilag. acaciæ. q. s.
Fiat massa, in pilulas quadraginta et duas dividatur: dosis pilulæ tres nocte maneque.

Take of gum Guaiac two drachms, blue pill one drachm, powder of foxglove one scruple, opium in powder ten grains, acacia mucilage as much as will suffice to form a mass. Divide it into forty-two pills, of which three are to be taken night and morning.

℞ Terebinthinæ Chiæ ʒj.
Pulv. antimonialis ℈j.
Guaiac. resin. ʒß.
Misceantur in massam, cujus formentur pilulæ viginti et duæ. Sumat tres nocte maneque.

Take of Chio turpentine one drachm, antimo-

nal powder one scruple, Guaiacum half a drachm. Mix them into a mass, of which form two and twenty pills. Take three night and morning.

℞. Pilulæ hydrarg. submur. comp. grs. ivß.
Opii pp pulv. gr. ß.
Fiat pilula. Bis in die sumenda, et sumat æger eodem tempore.
Decoct. sarsæ comp. f. ℥iv.

Take of Plummer's pill four grains and a half, opium in powder half a grain. Make them into a pill, and let one be taken twice a day, the patient drinking at the same time four fluid ounces of compound decoction of sarsaparilla.

Compositions of the above kind may be varied almost ad infinitum according to circumstances; and it may be proper, after a trial for some time of one formula, to have recourse to another. In but too many cases the disease will be found to baffle our varied endeavours. Warm clothing will prove one of the best alteratives. The subject of chronic rheumatism should not be contented with wearing flannel next the skin, but he should likewise wear the wash or chamois leather, which will sometimes prove more efficacous than all the drugs in the materia medica. Bandaging rheumatic limbs with very tight rollers has, in the practice of some, proved greatly available; and beating or rubbing them daily (the former is the most efficacious), will occasionally prove signally beneficial. Acupuncture and shampooing, the first consisting of running into the skin the fine points of several very small needles together, the second pinching and kneading it, are recently revived practices in this country, and sometimes are attended with very considerably efficacy. Warm bathing is usually employed, and lately the vaporous sulphur baths have been much in vogue; but it is questionable whether these last do not owe their efficacy to the penetrating quality of the vapor rather than to the specific operation of the sulphur. Electricity, more especially the voltaic electricity, or galvanism, is occasionally employed with decided and extensive advantage in cases of paralysis, consequent upon chronic rheumatism.

363. *Gout.* Podagra.—What is called a fit of the gout seldom makes its visit till after the age of puberty, though to this rule there are occasional exceptions. It seizes the first joint or ball of the great toe, which, with violent and peculiar pain, becomes also red, and in some degreee swollen. This attack is for the most part in the night after the first sleep; it lasts sometimes, with little abatement, for twenty-four hours, and then becomes mitigated; it again, however, recurs after the intermission of a day or two, and thus continues to harrass the sufferer from ten to twenty or thirty days, more or less; for even in what is called regular gout there is much irregularity in point of time. The gouty individual, having thus had his first fit, sometimes enjoys a respite for a few years, and in the first attack the locality is for the most part that just mentioned; but after three or four regular fits the feet, the hands, wrists, and other joints are affected, and the paroxysms come to visit more frequently, viz. annually, or twice or thrice in the year. Of the varying modes and aspects of gout the reader will find a good account in the appendage to the definition; but he must expect to find, in practice, even still more irregularity than is there set down. The atonic or misplaced form of the disorder especially falls upon the stomach, producing dyspeptic symptoms; upon the lungs, giving rise to asthmatic conditions; upon the heart, occasioning syncope; and upon the head, leading to vertiginous disorder; and upon the hœmorrhoidal vessels, giving occasion to piles The kidneys also are very commonly affected in this vicarious way in gouty subjects, to such an extent, indeed, that some have thought gravel and gout to be merely different expressions of the same malady.

Causes.—Gouty predisposition is constituted by a peculiarity of temperament; there is often fulness of vessels and an apoplectic make. It is hereditary; the natural tendency being increased by very high living, and by all those habits of indulgence to which the gouty are often constitutionally inclined. These indulgencies sometimes prove actual excitants of the disorder; and at other times the paroxysms are brought on by precipitately changing from voluptuous to abstemious modes of life; by exposure to cold at the time the predisposition is high; by the cessation of accustomed employment. It is always a fearful thing for a gouty merchant or tradesman to retire from the bustling anxiety of a city existence to the solitude and good living of country retirement; by inordinate evacuations; by mental anxiety, as well as mental ennui; in a word whatever tends to general derangement will be likely, in the disposed to gout, to bring on the fit. There seems in gout to be a predisposition to the secretion of lithic acid, with an accompanying alkali in small quantities; but whether the constitution which produces gout merely gives power to withdraw this secretion from the blood with more than ordinary readiness, or whether there is actually more of the material existing in the blood, does not seem to be satisfactorily ascertained. Certain it is that the same degree of digestive and general derangement happening in subjects not goutily disposed will not occasion gout, so that it is in one sense improper to look upon the affection as a mere stomach complaint.

Distinctions.—From rheumatism gout is distinguishable by the latter being as it were more constitutional, and having more obviously to do with deranged viscera; by the frequent presence of calculous disorder, and chalk stones as they are called, in the small joints, and by the metastatic or translated affection being often of a spasmodic or tonic kind, while in rheumatism it is more inflammatory. The perspirations in gout have also for the most part more acidity than in rheumatism, and gouty subjects are for the most part salacious, a constitutional bias which does not seem to have any thing to do in the way of connexion with rheumatism. For other marks of distinction see under the head of *Rheumatism.*

Prognosis.—Gout is not in general a disease in itself of danger, indeed the general feeling among pathologists and practitioners is that it rather preserves the constitution from formidable

advents of other maladies. This principle has, however, been combated by Heberden, Beddoes, and others Certain it is that, when a person dies of gout, it is rather of the consequences of the malady than of the malady itself; and the fatal termination seems in some measure connected with a want of power to produce a full paroxysm of inflammation; the humoral pathologists would say, a want of power to throw off the gouty matter which thus falls on the interior and occasions death. Apoplexy is exceedingly frequent in gouty habits; and formidable and even fatal affections of the stomach and heart, so as to cause death, do not seldom occur as a consequence of the gouty diathesis being very strong. The presence of chalk stones proves an inveterate diathesis, and often argues a fatal tendency.

Treatment.—When the local disorder is very considerable, it may be moderated by topical blood-letting, that is by the application of leeches, and refrigerant lotions; but the repression of the topical inflammation ought not to be effected precipitately, especially when the subject is advanced in age and his constitution has been debilitated by protracted disease. When the inflammation is not particularly high, but the pain still considerable, relief is sometimes obtained by the application of a camphor poultice, about a drachm or two of camphor being mixed with crumb of bread, and made into the consistence of a poultice with warm water. Warm and anodyne fomentations may also be employed. Some suppose, and with probably good reason, that beyond keeping the bowels attended to, and obviating as much as possible derangements in the digestive organs, the art of medicine is not capable of rendering any effectual or safe assistance; since shortening a paroxysm by the interposition of drugs or other remedial measures is calculated to hasten its return and eventually to increase and protract the disorder. It is certain that some medicines possess the power of lessening for a time the violence of gouty action. Elaterium as in rheumatism will do this. See *Rheumatism*. The colchicum too seems still more adapted to gout than it is to rheumatism, and the celebrated specifics seem principally to be made up of this last medicinal. Opiates combined with antimonials or calomel may be occasionally used; and the formula which will be found under the head of *Chronic rheumatism*, consisting of compound powder of ipecacuan and calomel, may occasionally be taken with considerable benefit. In all cases the bowels should be kept in action, and the warm resinous cathartics are rather indicated in old cases than the saline refrigerants. A combination also of the alkaline principle with the purgative is often requisite.

℞ Sodæ subcarb. exsic. ʒß.
Extracti colocynth. comp. ʒiß.
Mucilag. acaciæ q. s.

Fiat massa in pilulas xxiv. distribuenda. Sumat tres pro dose.

Take of subcarbonate of soda dried half a drachm, compound extract of bitter apple a drachm and a half, and of acacia mucilage a sufficient quantity. Make into a mass, and divide it into twenty-four pills. Three for a dose.

℞ Tinct. rhei f. ℥ß.
Liquoris potassæ subcarb. f. ʒß.
Infusi rhei f. ℥i.

Fiat haustus.

Take of tincture of rhubarb a fluid half ounce, liquor of subcarbonate of potass a fluid half drachm, infusion of rhubarb a fluid ounce. Make a draught.

Sudorifics may be occasionally employed; but we must not be very free in the employment of antimony when the powers of the system are rather low.

Fits of atonic or retrocident gout are best treated by volatile alkali, which medicine serves the combined purposes of an antacid and excitant, and sudorific.

℞ Ammoniæ subcarbonatis ℈ß.
Confect. aromat. ℈i.
Aquæ puræ f. ℥iß.

Fiat haustus.

Take of subcarbonate of ammonia ten grains, aromatic confection a scruple, water a fluid ounce and a half. Make them into a draught.

Or if there be much inflammatory condition, while atony is at the same time conspicuous, the liquor ammon. acet. may be supersaturated with five or six grains of the subcarbonate of ammonia, and in order to increase the secretion of urine a fluid drachm of the nitric ether may be added to the draught. When the stomach is attacked with gout, large quantities of stimuli are required, and ammonia with aromatic confection is the best form of administering them, but brandy or warm wine may be employed in the absence of more positive medicinals. Sulphuric ether, and ginger, are also useful in atonic and retrocedent gout.

The returns of gouty paroxysms are best prevented by an abstemious mode of diet, or rather by regular habits of living; by keeping the bowels acted upon, and preserving the urinary and cutaneous discharges free, regular exercise must also be taken. The aperients that are used should have reference to the prevailing acidity and the tendency towards obstruction or wrong action in the kidneys.

℞ Pulv. rhei ʒi.
Liq. potassæ subcarb. q. s.

Fiat massa in pilulas xvi. distribuenda. Sumat tres nocte maneque.

Take of powder of rhubarb a drachm, liquor of subcarbonate of potass as much as is sufficient to form a mass, which divide into sixteen pills, and administer three night and morning.

℞ Sodæ subcarbonatis exsic. ʒi.
Saponis duri ʒi.
Pulv. rhei rad. ʒß.
Aquæ q. s.

Fiat massa in pilulas xxxv. divide; et sumantur tres vel quatuor omni nocte.

Take of dried subcarbonaté of soda and venetian soap of each a drachm, powder of rhubarb half a drachm, water as much as is sufficient to form a mass; let it be divided into thirty-five pills, and give three or four every night.

Magnesia is a good aperient in gouty habits.

on account of its antacid and lithonthriptic qualities.

℞ Magnesiæ subcarb. ℈ij.
Spiritus ammoniæ aromat. f. ʒj.
Tinct. rhei f. ʒij.
Aquæ puræ f. ℥iß.
Fiat haustus.

Take of common magnesia two scruples, aromatic spirit of ammonia a fluid drachm, tincture of rhubarb two fluid drachms, water a fluid ounce and a half. Make them into a draught.

The continued use of bitters in gouty atony is a practice of questionable propriety; they have been supposed to give a tendency to apoplexy and paralysis, by curing or keeping under the gout, and thus fostering the tendency to these vicarious disorders. This may or may not be a correct notion; but, at any rate, the habitual employment of medicinals is an evil; and those medicines are more objectionable that do not act upon the secretions, as upon the skin, the kidneys, the liver, or the intestinal canal. We would not advocate the practice of giving for a constancy even purgatives, and diuretics, and diaphoretics, but they are, perhaps, less objectionable than the permanent employment of tonics and stomachics. Were it only that these last medicines excite to larger meals than the stomach is in a fit state to digest; this, in itself, would form an objection to them, and perhaps after all this is the principle upon which their protracted administration is objectionable as medicines against gout.

The Portland powder, which was formerly a fashionable anti-arthritic, is composed of equal parts of the roots of gentian and round birthwort, of the leaves of germander and ground pine, and of the tops of the lesser centaury, all dried.

Bath waters are useful in old gouty cases, but they have no specific agency. Indeed Heberden, who may be considered as high authority in gout on account of his practice being principally among the higher classes of the community, is altogether sceptical as to any good effected by them.

The student will observe in the nosology odontalgia (tooth-ache) and arthropuosis (joint disease) marked as genera of the order phlegmasia; but the consideration of these, beyond their being merely rheumatic affections, we refer to the article SURGERY. The remedies, however, noticed under the head of chronic rheumatism, will often beneficially apply to those affections of the joints which Dr. Cullen would designate by the term arthropuosis.

364. Order 3. RASHES ATTENDED WITH INFLAMMATION OR FEVER. Exanthemata.—Under this head we are to include, according to the nosological arrangement we follow, small pox, chicken pox, measles, scarlet fever, plague, St. Anthony's fire, the miliary eruption, vesicular eruption (pemphigus), and thrush.

For general remarks, on the principles of febrile eruption, we refer to the preliminary discourse attached to the present article.

365. *Small pox*. Variola.—The fever which precedes the eruption of the small pox is attended by pains in the loins and back, as well as pain in the epigastrium, noticed in the definition; there is often considerable drowsiness; and it is by no means uncommon for epileptic fits to make their appearance before the breaking out of the eruption. The first appearance of variolous eruption is like the bites of fleas; they usually come out first on the face, neck, and breast, and successively extend over the whole body. About the fifth or sixth day a small vesicle with a depression in the centre, and containing a fluid nearly colorless, is observable on the top of each pimple. Now some degree of swelling in the throat, and difficult deglutition come on, which, on the eighth day, has extended to the face and eye-lids, and at this period the pustules are fully formed. On the eleventh day the swelling of the face subsides, the matter in the pustule has changed to an opaque yellow, and the hands and feet begin to swell. There is now, too, an appearance of what is called secondary fever, which gradually subsides, and disappears on or before the seventh day.

When the small pox is what is called in the nosology confluent, a more violent fever precedes the eruption, while the rash itself breaks out in a more hurried and irregular manner. The eruptions assume an erythematic character, running into each other, and do not suppurate kindly, but contain an ichorous brownish matter; the swelling of the face, and the salivary discharge commence earlier, typhoid symptoms make their appearance, and often petechiæ are observed on the skin; blood is also discharged, by stool, and sometimes even by the urine; the bronchial cavities seem to be laden with irritation, and the little patient often dies suffocated.

Causes.—Specific contagion. This may be received either by the lungs or the skin; but in the latter case it is necessary that puncture or abrasion be used. Although the virus of small pox is exceedingly subtile, it does not appear to have the power of penetrating the scarf-skin, and thus making its way into the blood-vessels or absorbents.

Prognosis.—Now that the proper principles of treatment in small pox have come to be understood and acted upon, the prognosis may in general be considered favorable. In the confluent kind, however, there is always much to fear, on account of the typhoid tendency of the accompanying fever. The unfavorable indications are the flattening of the pustules, or disappearance of the eruptions, with a subsidence of the swelling of the face; the breathing becoming much oppressed or obstructed, and marks of inflammatory and congestive conditions about the head or the liver.

Distinctions.—A common attack of febrile disease is usually distinguishable from the fever preceding small pox, by the latter being attended by pain in the loins and tenderness in the epigastrium; and there is in general more of drowsiness in the fever preceding small pox eruption. When the eruptions break out they are distinguished from measles by being larger, fewer, more distinct, and more papular; from the chicken pox, by their being more distinct and

circumscribed, as well as more uniform in size; and, by a more regular and gradual progress of preliminary fever, and eventual suppuration. The pustule too is cellular and depressed in the centre, if it be genuine small pox.

Treatment.—It is merely necessary, in common small pox of the distinct kind, to enjoin a cool regimen; and if the fever runs high to administer saline and aperient medicines, as in common fever. If there is much restlessness, the addition of a little syrup of poppy, as in the following draught, will be found useful:—

℞ Liquoris ammon. acet. f. ℥ß.
Syrup. papav. f. ʒij
Sp. ætheris nitric. f. ʒj.
Aquæ puræ f. ℥i.
Fiat haustus.

Take of liquor of acetate of ammonia half a fluid ounce, syrup of white poppy two fluid drachms, spirit of nitric ether one fluid drachm, water a fluid ounce. Make them into a draught.

In the confluent small pox, the treatment is rather that demanded in typhoid fever. A combination of nitre and cinchona bark will often be found useful; and it will be expedient to preserve the bowels free. In tendencies to sinking, especially if the eruption appears to recede, or manifest an inward direction upon the mucous lining of the bronchiæ, the subcarbonate of ammonia must be given, and blisters applied to the chest. If diarrhœa be urgent, administer opium with ammonia; and in some cases a combination of calomel and opium in equal doses, say from a quarter of a grain to a grain of each, according to the age and circumstances of the patient, will be desirable. Here it is allowed that the mucous surfaces are in a state of erythematic irritation, but it is that kind and degree of inflammation which will often best yield to bark, wine, opium, and cordials; or, at least, those must at all events be given when the system is sinking. Even in more distinct small pox, when the pock becomes flattened, and manifests an indisposition to come freely out, ammonia may be administered with signal advantage; should there be much febrile action at the same time, it will be right to supersaturate the saline draught with the subcarbonate of ammonia.

[*Note*—In the above account we have treated of the distinct and confluent small pox, as if they were different kinds of disease; it should, however, be remarked, that the kind rather refers to the state of the individual and to epidemic constitutions in the air, than to any abstract or essential difference in the virus itself; the most confluent will produce in another the most distinct, and vice versâ.]

It might be expected that we should in this place enter upon a disquisition upon the substitute for small pox—the vaccine matter, but we purpose to devote a separate article to this important topic; and, under the word Vaccination, the reader will find a full estimate of the comparative merits of the small pox and vaccine inoculation.

366. *Chicken pox*, varicella.—The definition is a sufficient history.

Distinction.—We have already stated the principal points of distinction between this eruption and that of small pox. It is generally about the fifth day at furthest that the eruption disappears; and, unlike the small pox, it often commences about the hip and back.

The *prognosis* is always favorable; and the *treatment* necessarily simple. Indeed medicine is scarcely at all required; or, at furthest, some gentle aperient to keep down the little irritation that may be induced.

It has been contended by some, more especially by Dr. Thomson of Edinburgh, that small pox, the vaccine virus, and the varicella, or chicken pox, are mere degrees and modifications of the same poison. Others have advocated their essential distinction. On this head we shall have further to remark when treating of cow-pox under the word Vaccination.

367. *Measles.* Rubeola. Morbilli.—The prominent symptoms of this disease are exceedingly well pointed out in the nosological definition. The eruption usually appears first about the face and neck, and successively spreads to other parts of the body. The fever does not, as in small pox, abate upon the appearance of the eruption, but rather increases as do the catarrhal symptoms. Sometimes the eruption at first appears to come out full and free, but very soon disappears, and oppression of the præcordia, difficulty of breathing, and other internal symptoms present themselves. At other times, during the whole course of the disease, the skin shall be but just sufficiently marked to prove the existence of the complaint, and scarcely that. On the very day that we are writing these remarks, we have seen a child who is evidently laboring under the influence of measles' virus, but whose disorder would scarcely even be suspected measly, were it not that other children of the same family are simultaneously, and these obviously affected.

Causes.—Contagion as in small-pox. It is curious that small-pox and measles were treated of in the first instance as one and the same disorder; and, as the identity of vaccine virus with varicella and variola has been imagined, so has it been further supposed by some that measles and small-pox poison have only become essentially different by the operation of time and circumstance.

Distinction.—From small-pox in the first breaking out by the presence of catarrhal symptoms, and by the more clustered and less papular appearance of the eruption. Measles constitute a sort of midway eruption between the more distinct papula of the small-pox, and the more erythematic and rashy character of scarlatina; from this last measles are also distinguishable by the coryza and sneezing as opposed to the cynanchial irritation of scarlet fever.

Prognosis.—It is rather fearful to give a favorable prognosis of measles from their first appearance, and for the first few days we should always leave it open to contingencies; for sometimes the skin affection will appear to come out free and favorably, and then will suddenly, and without apparent cause recede, and internal damagement will take its place. If the fever run high; if the difficulty of breathing be considerable; if delirium take place, if the eruption display an internal tendency, if it assume a pallid appearance,

especially if it become livid; and petechial spots are intermixed with it; considerable danger is to be apprehended. Much diarrhœa and vomiting are bad symptoms; but slight diarrhœa with a free skin and easy expectoration are favorable signs. It is always well to see a good and regular crop of eruptions.

Treatment. The indications are to keep down excitement; to guard against or combat local inflammation, especially inflammation of the lungs; and to excite and stimulate when the powers of the system seem to be sinking.

Excitement is to be moderated by an equal temperature, carefully preventing sudden or partial applications either of heat or cold; for, although it is not expedient to pursue the heating and alexipharmic plans of former times, we cannot on the other hand adopt the cooling practice quite so freely and fearlessly as in the small-pox, on account of the tendency of the eruption to recede upon the internal membranes, and on account of the catarrhal irritation that is always in a greater or less degree present. Saline purgatives are to be given as in common fever, according to the measure of the pyrexial irritation; general blood-letting may be had recourse to if the patient be an adult, and the phlogistic diathesis runs high, but for the most part this is not necessary. Leeches must be applied to the chest if the pulmonary symptoms become urgent, or to the head should delirious and phrenetic irritation manifest themselves. Digitalis is for the most part a useful medicine in measles, and it may be joined with nitre and poppy syrup, as in the following formula.

℞ Tincturæ digitalis purp. ♏ x.
Syrup. papaveris f. ʒiß
Pulv. potassæ nitrat. ℈ß.
Misturæ amygdalæ f. ℥iß.
Fiat haustus.

Take of tincture of digitalis ten minims, syrup of white poppy a fluid drachm and a half, nitre ten grains, almond emulsion a fluid ounce and a half. Make them into a draught.

When the internal tendency of the eruption, as above alluded to, becomes combined with much debility and sinking, the subcarbonate of ammonia will prove one of the best medicinals, since it has a sudorific as well as a stimulant quality (see under *Confluent small-pox*; the same indications being present, and the same rules applicable).

The cough which follows measles ought to be carefully attended to, and moderated by attention to diet—by the administration of digitalis, or hyoscyamus, or conium, or poppy, or a combination of some or all of them; and the child be removed to a mild air. If the pulmonary irritation become considerable and protracted, a blister may be laid on the chest, or the tartrate of antimony ointment applied; for if these indications of remaining disorder be not got under, they are apt, in their continuance to lay the foundation for future phthisis.

368. *Scarlet fever.* Scarlatina.—There is some uncertainty in respect to the time at which scarlet fever first made its appearance. It has been supposed by some to be a modification of some of the other eruptive diseases, but there seems a good deal of difficulty attending the investigation respecting the precise point of time, and the particular part of the world, in which this and some of the other acute affections of the exanthematous kind first appeared in a distinct and decided form. 'It has been suspected that the contagion came originally from Africa. Be this as it may, it first broke out in a severe form in Spain in 1610, from whence it spread to Naples where it raged epidemically in 1618. In 1689 the same disease made its appearance in London, and was described by Dr. Morton, though not with the accuracy of the first Spanish and Italian authors. In 1735 it broke out in North America and spread gradually but slowly over that continent. One of the most curious circumstances in the history of the disease is the slowness of its diffusion.'

Symptoms.—The definition comprehends almost all the common symptoms of the complaint. The inflammation of the skin appears as an erythema, and is not phlegmonous, nor papular; the accompanying fever showing often a typhoid tendency, especially when the tonsils are much ulcera'ed. The face is often sensibly swelled about the third day. Scarlet fever, like the measles, is various in respect to the freedom with which the cutaneous affection appears; sometimes we have a promise of a large crop, or rather of a universal redness, which in a few hours recedes, and becomes pale; sometimes the throat is malignantly affected; at other times there is scarcely any tonsil disorder. The sequelæ, too, of the fever are very irregular, health and strength gradually, at times, following upon the cessation of the complaint in its active form; while at other times, after a day or two of good promise, languor and weakness are felt, the urine becomes scanty, and dropsical tumefactions make their appearance. For the most part, these are confined to the skin; but now and then, especially if there have been much pulmonary or abdominal affection during the fever, symptoms become manifest of hydrothorax or ascites.

Causes.—Contagion of a specific nature, communicated it should seem as other contagions by the respiratory organs, the outer skin forming a complete barrier to its entrance into the system; the power of infecting is said to continue certainly a fortnight from the time of the eruption.

Distinction.—From measles (see *Measles*). From small-pox (see *Small-pox*). The distinction proposed between malignant sore throat and scarlatina cynanchica does not perhaps exist; for, although a malignant ulcer in the throat may be occasioned without the specific poison of scarlet fever being applied, we often see several children of a family affected simultaneously, one having the sore throat without having the skin disorder, another having the eruptive without the cynanchial complaint. Indeed, it is now pretty generally supposed that scarlatina and cynanche maligna are produced by the same specific contagion.

Prognosis.—For the most part, upon the whole, more favorable than measles, since the internal tendency upon vital organs is not so great. The later and less hurried the eruption, after the first

appearance of fever, the better; and the fever assuming less of the typhoid type is favorable. The unfavorable symptoms are delirium; coma; præcordial anxiety; hurried respiration, with a thick voice and difficult deglutition; partial patchy eruption, instead of a full and universal floridness of skin; pains about the angle of the jaws, and ears, with acrid running from the nasal membrane or meatus auditorius; saliva tinged with blood; and dry contracted skin.

Treatment.—That of fever generally. Moderate the excitement when high, as in fever. When the eruption is full out upon the skin, and there is no perspiration, cold water may be used freely to the surface. When the eruption is disinclined to come out, and torpor without signal typhoid tendency prevails, the subcarbonate of ammonia may be used with much prospect of benefit. Nitre and cinchona bark in combination, as mentioned in malignant small-pox, will be found applicable in the typhoid form of the disorder; the mineral acids too may be ordered; and the frequent use of acidulated gargles is called for. It is often necessary to syringe the throat of children, or to apply more stimulant solutions in case of a sloughing appearance of the tonsils.

℞ Hydrargyri oxymuriatis gr. vj.
Mellis rosæ f. ℥ij.
Aquæ puræ f. ℥vi.

Fiat solutio; tonsillis ulceratis sæpe applicetur parvis quantitatibus ope penicilli.

Take of oxymuriate of mercury six grains, honey of roses two fluid ounces, water six fluid ounces. Make a solution, of which apply a small quantity frequently to the ulcerated tonsils by means of a hair pencil or sponge.

Blisters are sometimes called for in these and other eruptive complaints; but they ought to be used with some reserve, when there is a gangrenous or highly typhoid tendency in the habit, as in this case they are apt to produce sloughing and exhausting sores.

As a consequence of scarlatina we frequently find dropsical swellings of the skin in different parts of the body; and sometimes dropsical accumulations in the cavities. These would seem to result from the exhausted state of the exhalant vessels on the surface, they having been stimulated too much in the inflammatory period of the disease. A difference of opinion has prevailed with respect to the method of treating this kind of dropsy following scarlatina, some recommending bleeding, while others prescribe tonics. Perhaps we should be guided in this, as in other cases, more by the attendant circumstances than by abstract considerations. Where there is much of arterial action in connexion with the œdema, we ought to be careful of introducing tonics with much freedom; at the same time the debilitated condition of the system and of the exhalants worn down by protracted disorder ought to be taken into the account. It is worthy of remark that Dr. Gregory, who spoke highly of the bleeding and depletory plan of treatment (under these circumstances), in his lecture on dropsy states, in his Practice of Physic, that he has met with several cases which appeared to indicate the propriety of bleeding and purging, but which resisted both, and ultimately yielded to bark and aromatic confection. Dr. Uwins speaks of the very gradual introduction of foxglove into the system under these circumstances as calculated to meet both demands of reducing arterial irritation and obviating lymphatic debility. When foxglove is used with these intentions it should be commenced in doses (for a child four or five yeare old) of two or three minims, and increased to eight or ten by an additional minim at each dose. See *Dropsy*.

369. *Plague.* Pestis.—We have been so pleased with the succinct account which Dr. Gregory gives of the peculiarities, and habits, and circumstances of the plague, that we shall take the liberty of extracting the whole section of his book which refers to this subject; referring the reader to its more enlarged consideration under the words PLAGUE or QUARANTINE in this Encyclopædia.

The plague, classed by Dr. Cullen among the exanthemata, is yet, in strict nosological language, a continued fever closely applied to typhus, and therefore demanding notice more particularly in this place. It may be viewed indeed, without over-refinement, as the link which connects these two great classes of idiopathic fevers. In its mode of propagation it resembles the exanthemata. In its symptoms and progress we shall trace an obvious resemblance to those of typhus.

The historical details connected with this very singular disease are highly interesting. The ancients do not appear to have been acquainted with it; but it must be confessed that its origin and early history are involved in much obscurity. For many centuries past it has been endemic on the shores of the Mediterranean; and though it has occasionally shown itself in other latitudes, as at Moscow in 1771, and in this country in 1665, yet in that situation only is it at all times to be met with. Grand Cairo may be considered as the great nidus of the contagion of plague; and from this point, at particular seasons, it spreads with a malignity scarcely to be estimated. The interest with which such a disease must at all times be viewed has been much heightened of late years from the circumstance of its having appeared in our own settlements (in 1813 at Malta, and in 1816 in the Ionian Islands), and been subjected there and in Egypt to the observations of our own countrymen. The symptoms of this disease, the peculiarities in the laws of the contagion of the plague, and the circumstances which appear to favor its diffusion, and the consequent appearance of the disease as an epidemic, are the points to which our attention will, in this chapter, be principally directed.

A feeling of great languor and lassitude usher in the attack of plague, which for the most part happens towards evening. There is always a cold stage, though it is seldom of long duration. Heat of skin, head-ache, and giddiness succeed. The pain of the head is referred to the temples and eye-brows. The eyes appear heavy, dull, and muddy. The expression of the countenance changes in a remarkable manner. Sometimes there is a wild and furious look; sometimes a look claiming commiseration, with a sunk eye

and contracted feature. The most striking of all the early symptoms of plague is the staggering, and the sudden extreme prostration of strength. A strong tendency to void the urine is generally noticed. The stomach is very irritable, and rejects almost every thing presented to it. The tongue is white and moist. The bowels are sometimes torpid, and at other times loose, the evacuations being always highly offensive. The speech faulters. The pulse is at first small, hard, and quick; but, after the appearance of buboes, it often becomes fuller and softer. It is sometimes intermittent. In point of frequency its average may be stated at 100. The heat of skin is seldom very intense. The head is occasionally perfectly clear and collected. At other times stupor occurs immediately after the formation of the hot fit. Some cases of the disease are ushered in by a violent fit of mania. The greatest indifference with regard to recovery prevails, and is always reckoned a most unfavorable symptom.

After one, two, or at furthest three days, pains in the groins and axillæ announce the formation of buboes. These pains are often highly acute, and, unless speedily followed by the swelling of the gland, the patient dies delirious. In women the axillæ, in men the groins, are chiefly affected. Carbuncles appear at the same time, but indifferently on all parts of the body. Petechiæ and vibices are much more frequent than carbuncles, which it appears do not occur above once in twenty cases. The fatal termination is sometimes preceded by violent hæmorrhages from the mouth, nose, or intestines.

The duration of the disease is very various. A few cases are on record where the patient died within a few hours from the invasion. To many it proves fatal during the first paroxysm or period, which includes the time from the evening of the attack to the close of the following night. The third and fifth days are however, upon the whole, those of the greatest danger. The former is the usual period of the appearance of bubo; the latter of the abatement of the febrile symptoms. If the patient survives the fifth day, and the bubo is fully formed, he may be considered as nearly out of danger. The convalescence indeed is always very tedious, from the extreme debility which the disease leaves; and the patient's life is not unfrequently again put into imminent hazard from the occurrence of gangrene in the extremities.

Such is the train of symptoms which characterises this disease. To form some idea of the extent of the mortality which it occasions, I may mention that out of 700 persons attacked by it in the district of Leftimo in Corfu, in 1815, seventy were saved, and 630 died. It is curious however to observe that, occasionally, this very formidable disease assumes a totally different character. The mild form of plague is not peculiar to any families, or classes of persons, or districts, or periods of the epidemic. It is more commonly met with towards its decline, but it is observed occasionally even from the very first. Buboes form in this variety of the disease about the usual period, generally with a good deal of inflammation, and go on to suppuration. Carbuncles and petechiæ, however, are never observed to attend it. It is marked by the same set of febrile symptoms as characterise the malignant form of the disease, but they are all milder in degree. It terminates occasionally by a critical discharge, but does not appear to require, or to be at all affected by, any kind of medical treatment. A few cases have been recorded of plague appearing in the form of buboes, without any constitutional affection.

A circumstance of some importance, as tending to point out the analogy between the plague and other forms of continued fever, has been taken notice of by Sir James M'Grigor, in his Medical Sketches of the Expedition from India to Egypt:—I mean the effect of season, ventilation, and peculiarities of soil, in modifying the character of the symptoms. The cases of plague which occurred in the cold months of the year were marked by an inflammatory diathesis. Those which were sent in from crowded hospitals were attended from the very first with low or malignant symptoms. Those which occurred when the army was encamped near the marshes of El-Hammed showed a kind of remittent or intermittent type.

Some dissections have been made of the bodies of persons who have died of the plague, but they afford little or no instruction. The few morbid appearances noticed were met with in the cavity of the abdomen.

In the malignant form of plague every variety of treatment has been tried, but with so little effect that it may be considered as a disease nearly beyond the reach of medicine. The violent head-ache which occurs during the first twenty-four hours seems to point out the propriety of blood-letting, and is recommended by the general custom of the Turkish practitioners; but in the hands of English surgeons it proved of no avail. In the cases in which it was tried it did not appear, however, to make matters worse. The blood first drawn was generally sizy, but never afterwards.

Where mercury can be brought to affect the mouth it appears to be of some service, but it is seldom that sufficient time is afforded for this specific effect of the remedy. Ether and laudanum are valuable medicines in allaying the irritability of the stomach. Wine and opium are of no use during the violence of the disease, and bark can seldom be retained. This is much to be regretted; for wherever it can be made to stay on the stomach, even in those severe cases where carbuncles and vibices appear, its good effects are conspicuous. Camphor, bark, and wine are given with much advantage during the period of convalescence. Emetics, purgatives, and the cold affusion have been tried, but it does not appear that they are of any particular service. Diaphoresis can seldom be produced, owing to the disposition to vomit; but wherever it can be procured the symptoms seem to be mitigated by it.

Great attention is always paid to the local treatment of the buboes. They seldom go back, and it is usual, therefore, to employ means with the view of accelerating their suppuration. For this purpose the Turks are in the habit of applying the actual cautery, but it did not answer in

the practice of our army surgeons. The irritation occasioned by it was excessive, so as sometimes to hasten the patient's death. Blisters and poultices are certainly preferable; but, upon the whole, it is quite obvious, that as little can be done in the way of surgical treatment in the plague as by internal medicines.

The general resemblance which plague bears to those malignant forms of typhus fever, which are occasionally witnessed in cold countries, must be abundantly obvious. The great distinction between them lies in the occurrence of buboes; in other words, in the tendency which plague has to affect the lymphatic system. This line of distinction, however, is so broad, that plague is to be viewed as a continued fever, allied indeed to typhus, but differing from it in the important circumstance of having its origin in specific contagion. That the plague is a highly contagious disease cannot for a moment be made a matter of dispute; but some physicians have maintained that it is not a fever sui generis, generated by a specific contagion, but only an aggravated form of typhus, in support of which opinion it has been argued, that cases of typhus complicated with buboes have sometimes been observed in this country. This idea, however, is entertained only by a few, and the doctrine of a specific contagion in plague is that which is now generally received. Its laws have been investigated with some accuracy, and the following seem to be the most important of those which have hitherto been ascertained:—

1. The latent period of the contagion of plague, or that between communication with an affected individual and the appearance of symptoms, varies in different cases. It is scarcely ever less than three days, and it seldom exceeds six. Instances are recorded of the disease not appearing until the tenth day, but these cases are rare.

2. The contagion spreads to a very small distance only from the body of the patient. The consequence of which is, that the disease is seldom if ever communicated, except by actual contact.

3. The dead body does not communicate the disease so readily as the living. This, I understand, is well known in Turkey, but that the contagion is sometimes received from the dead body cannot, I apprehend, be doubted.

4. The contagion of plague is readily imparted to fomites, in which it may lurk for a very long time, more particularly if secluded from the air.

5. Re-infection is occasionally observed, but, upon the whole, it is not common. The individuals throughout Turkey, who are employed about the persons of plague patients, have, with very few exceptions, undergone the disease. Sufficient instances, however, are met with of persons taking the disease a second time, and even dying of the second attack, to make all who have previously had it cautious in their intercourse with the affected.

6. Plague, like the small pox, may be taken by inoculation. The experiment has been tried in several instances, but in none has it succeeded in mitigating the disease. Dr. Whyte in 1801, and Mr. Van Rosenfeldt in 1817, paid the forfeit of their temerity with their lives. The former died on the fourth, the latter on the second day of the disease.

Plague I have stated to be endemic in Egypt; and both at Cairo and Constantinople cases of the disease are almost always to be met with. In other words they occur sporadically in those places. While the English army was in Egypt, in 1801, cases of plague were continually occurring; but the judicious regulations which were adopted prevented the disease from spreading, and the troops suffered but little from it. At Malta however in 1813, and in the Ionian Islands during the years 1815-16, the plague raged epidemically; and from very early times it has been observed that, at particular seasons, the plague disseminates itself with extraordinary malignity. To this nothing can give any effectual check but the enforcement of severe measures by the strong arm of military power. At Marseilles in 1720, at Messina in 1743, at Grand Cairo in 1759, and on various other occasions, when the plague was suffered to advance without any such control, the ravages which it committed were of incalculable magnitude. The rigid seclusion of families, the immediate removal of all suspected cases to quarantine, and of all decided cases to the lazaret, are the preventive measures of most obvious importance.

Many enquiries have been instituted with the view of determining, if possible, what the circumstances are which render the plague epidemic at certain seasons. Some particular constitution of the air is generally supposed to occasion it, but what that is never has been, and probably never will be ascertained. The extremes both of heat and cold are said to be unfavorable to the propagation of plague; but this opinion must be taken with some limitations. The plague raged in summer at Malta, in the winter months at Corfu. Nor is it clear that it is upon any peculiar state of dryness or moisture in the atmosphere that the phenomenon depends, though indeed there is a popular belief all over the Levant that the heavy dews which begin to fall about St. John's day check the advance of the plague. To this circumstance is attributed the curious but well ascertained fact that, though the disease had been previously raging in the town, the inhabitants may, after that day, leave their homes, and mix in society with comparative security.

It is a common remark in the Levant that the advances of the plague are always from south to north. When the plague is at Smyrna, the inhabitants of Aleppo handle goods without precaution, and have no fears of contagion. When the disease, on the other hand, is at Damascus, great precautions are observed, and all the Frank families hold themselves in readiness to shut up, or to leave the town. An epidemic plague, therefore, nearly always begins at Grand Cairo, spreads to Alexandria, and from thence through Syria to Smyrna and Constantinople.

The seeds of the plague being always present in Turkey, if it were not for these peculiarities in the laws of its contagion, that country must have been long since depopulated. Whether the genuine Levant plague could spread in this cli-

mate is a point upon which physicians are not agreed. The general opinion is, that it might so spread under particular circumstances, and, therefore, that the quarantine regulations established by the legislature are absolutely necessary for the protection of these countries.

370. *St. Anthony's fire.* Erysipelas.

Symptoms.—This cutaneous affection is often ushered in with sickness, and much depression of animal power; the pulse is quick and sometimes hard; and, after a day or two, redness and tumefaction appear about the face and neck, which extends to the eye-lids, and closes the eyes; this continues to increase for some days, often accompanied by great pain in the head, and delirium, and at length it terminates in desquamation. Metastasis is very liable to take place in erysipelas to the brain, and sometimes to the lungs, producing in the first case delirium, and in the pulmonary translation difficulty of breathing and general pulmonary symptoms. The brain, however, is by far the most frequent seat of translated erysipelas. The head and face are not the only parts obnoxious to erysipelas; the legs sometimes are the seats of the disorder, and at other times different portions of the body's surface. For an account of that species of erysipelas which Dr. Cullen calls the phlyctænodes, see the *Appendix*.

Causes.—Irritations in the stomach and bowels; vicissitudes of temperature; over eating or drinking; suppressed evacuations, as of the menstrual discharge. In some there appears a more than common disposition to plethoric fulness and erythematic inflammation; and these are the subjects that are predisposed to erysipelas. Erysipelas seems sometimes contagious, and often endemic, as if from some peculiarities in the air.

Distinction.—Gout and scarlet fever are the complaints with which idiopathic erysipelas is most nearly allied in appearance; but these are easily distinguished from it by their accompanying tokens.

Prognosis.—In general favorable, but, not seldom, far otherwise; the kindly symptoms are, the comatose and delirious states leaving the patient as the efflorescence of the skin proceeds; this last shortly ending in a yellowish appearance, and not producing much vesication. If the fever continue urgent after the appearance of the efflorescence, assuming a typhoid type, and being protracted beyond the seventh day; if then the skin redness suddenly recede, and internal tendencies become marked with prostration of strength, and weak or intermittent pulse, the patient must be considered in a highly dangerous condition.

Treatment.—For the most part it is best to begin the treatment by an emetic; this being directly serviceable when the disorder is occasioned by stomach and bowel irritation; and indirectly, when it shall have had another origin, by reducing action. When the subject of the disorder is in a high condition of sthenic excitement, robust in his constitution, and breathing the pure air of the country, we may have recourse to pretty large blood-lettings; but these ought to be instituted with much reserve in crowded hospitals or cities, and when the patient is not constitutionally strong. In this case we must be content with saline purgatives or diaphoretics. Local blood-letting is seldom advisable in erysipelas: indeed, leeches often bring the disorder on when there is a constitutional bias towards its formation. When the frame seems sinking, and the disorder tends internally, give subcarbonate of ammonia; and, when typhoid symptoms are urgent, bark and the mineral acids are called for. In respect to topical applications, the repellent kinds for obvious reasons must be used with much reserve, and only then resorted to when the subject is young and vigorous, and the skin affection is at a distance from the head; sprinkling the surface with flour, or starch, or oatmeal, will sometimes take off the distressing burning of the skin by gradually absorbing the acrimonious moisture that oozes out from the inflamed vessels. In cases of internal disposition, warm fomentations or spirituous applications may be resorted to in order to restore the cutaneous action.

371. *Miliary fever.* Miliaria.—The definition gives the symptoms with sufficient correctness. The great characteristics of the disorder are the odor of the perspiration, and the præcordial anxiety. The eruptions are like millet seeds, sometimes red, and sometimes more white or pale-colored. They are occasionally produced by stomach disorder, but most commonly brought on by a heating, irritating regimen; by an overload of bed-clothes; and by confined heated apartments: and are, therefore, of comparatively unfrequent occurrence, in this day of antiphlogistic good sense. Their prevention and treatment are sufficiently obvious. In case of retrocession, succeeded by internal symptoms of an alarming kind, ammonia and cordials must be resorted to. In all cases it will be necessary to keep the bowels free, while attention is at the same time given to support the strength by bark and acids.

'To prevent the disease arising in pregnant women, costiveness,' says Dr. Thomas, 'ought to be carefully guarded against, and when in child-bed they should strictly observe a cool regimen.'

372. *Nettle-rash.* Urticaria.

Symptoms.—In addition to the definition it may be stated, that large wheals are occasionally observed on the skin as well as the small spots; and that the disorder sometimes lasts, or disappears, and appears again for some months.

Causes.—Exposure to colds and heats will sometimes bring on urticaria; at other times it is occasioned by substances taken into the stomach. Shell-fish will, in some individuals, invariably produce a nettle-rash; and these frequently occurring idiosyncracies have induced pathologists to conclude that in all cases, even of the more common and decided nettle-rash, the digestive organs are in some measure concerned in its production.

Treatment.—An emetic may generally be administered with propriety; and afterwards cooling aperients. In the chronic disease we are informed, that an infusion of serpentaria may be employed with advantage in the proportion of two drachms to a pint of water.

373. *Vesicular eruption.* Pemphigus.—This vesicular eruption is of rare occurrence, of uncertain origin, and does not seem to be influenced by medicine on any other principle than of keeping the stomach and bowels clear, and meeting the incidental excitement that may be present by a cooling regimen. Should the attendant fever assume a typhoid character, bark, mineral acids, and syrup of poppy, may be given. Pemphigus does not appear to be contagious.

374. *Thrush.* Aphtha.—The aphthous eruptions, that appear in the mouth and fauces, are generally accompanied by the same condition of parts, through the whole length of the intestinal canal, or at least through a considerable portion of it. They are merely indices of irritation growing out of debility, and are not under the control of any specific agents. When they take place in the diseases of old people, that have been of long standing, they are, for the most part, signs of approaching dissolution. The aphthæ of children generally denote a disordered state of the mucous tissues of the stomach and bowels. Dr. Thomas speaks of a chronic thrush as very common in the West Indies, and accompanied by a cachectic state of the general system. Aperients and detergent gargles are the remedies for aphthæ generally, and the mineral acids taken internally, according to the extent of excitement or degree of debility: but to attempt their removal, without removing their cause, is like an attempt to whiten an Ethiopian's skin.

375. Order IV. Hæmorrhages. Some remarks will be found on the general doctrine of hæmorrhage in the introductory disquisition, and we shall have to recur to the consideration in the article Physiology, when the forces which circulate the blood are under discussion. It is only for us now to go through the several genera contained in the order; merely reminding the reader that hæmorrhage takes place under opposite states of the system as to power, and that discharges of blood do not always imply actual rupture of the vessels containing it.

376. *Bleeding from the nose.* Epistaxis.—Hæmorrhage from the nose is generally an effort of nature, to relieve a congested or plethoric state of the blood-vessels about the head; and, unless immoderate, it is for the most part inexpedient to interfere with the discharge. When much general excitement prevails, the antiphlogistic regimen is to be adopted; if obstructed viscera, as of the liver or spleen, have caused it, emulgent purgatives are to be employed; and, in cases of old age and great debility, tonics and astringents may be required internally. The best local application are dossils of lint, or the scrapings from a beaver hat, put up the nostrils so as to plug them and permit a coagulum to be formed; the lint may be dipped in strong solution of common alum or sulphate of zinc. The sudden application of cold to any part of the body will sometimes stop epistaxis; hence the vulgar remedy of a key put down the back. Plunging the head in a pail of cold water, impregnated with salt, has been had recourse to with success when other plans have failed. It is a general observation, and one as old as Hippocrates, that persons who have bleeding at the nose when young are liable in after life to hæmoptysis and consumption.

377. *Spitting of blood.* Hæmoptysis.

Symptoms.—The definition is very accurate; there is sometimes a hard full pulse at the time of the discharge; the irritation is usually just at the top of the larynx, and there is often a saltish taste perceived.

Causes.—Scrofulous laxity, with plethoric fulness of vessel, predisposes to hæmoptysis; and the predisposing age is from sixteen to thirty-five. A narrow chest gives too a predisposition to the disorder, as does an obstructed state of one or more of the viscera; or a suppression of an accustomed evacuation; or obstructed perspiration.

The *exciting causes* are, violent exercise of the body or the lungs; excessive heat; the impure air of crowds; and mental agitation. The air, also, not otherwise impure, may be too much rarified.

Distinction.—From hæmatemesis, by the blood being frothy and florid instead of dark and grumous; by its coming up in the act of coughing rather than vomiting; on this point there is, however, occasionally some difficulty, from the circumstance of vomiting being a frequent attendant upon hæmoptysis; and by its being in smaller quantities than when it comes from the stomach.

Prognosis.—Unfavorable when the discharge indicates a phthisical state or tendency in the lungs, where it is not followed or preceded by much constitutional irritation. When it leaves behind it no difficulty of breathing, cough, nor pricking pain in the chest; and where there is no scrofulous habit, nor malconformation of the pulmonary organs, nor hepatic derangement, the prospect is favorable as to thorough and permanent recovery. It should be remarked, that the danger is in most cases rather remote than immediate, since death very seldom follows upon the mere quantity of blood discharged. Dr. Heberden tells us that he never witnessed but one case of a fatal termination of hæmoptysis from the actual loss of blood.

Treatment.—With a hard and jerky pulse, as it is called, and when the hæmorrhage is very considerable, repeated bleedings are called for, as in pneumonia; but it is by no means necessary to bleed in all cases of hæmoptysis. The antiphlogistic plan of treatment is invariably required when the hæmorrhage is of an active kind; heat in all forms and shapes must be avoided, and quiet enjoined. Saline purgatives are requisite, to which may be added tincture of digitalis; or this last may be given alone in doses of ten, gradually increased to thirty minims. The nitrate of potass is a good medicine in active hæmoptysis. The sulphuric acid is an excellent medicinal.

℞ Acidi sulphurici diluti ♏ xv.
Syrupi papaveris f. ʒj.
Infusi rosæ f. ℥iß.
Fiat haustus.

Take of diluted sulphuric acid fifteen minims, syrup of white poppy a fluid drachm, infusion of roses a fluid ounce and a half. Make them into a draught.

Should the bleeding continue in defiance of the above treatment, more active astringents will be called for, and one of the most efficacious is the acetate of lead.

℞ Plumbi acetatis gr. j.
Opii pulveris gr. ß.
Micæ panis q. s.

Fiat pilula parva; ter quaterve in die sumenda.

Take of sugar of lead one grain, powder of opium half a grain, crumb of bread enough to make a small pill, to be taken three or four times a day.

When this medicine is had recourse to, acids ought to be laid aside, otherwise bowel affections are likely to follow its use.

Blisters to the chest and back will occasionally be found useful in exciting a vicarious irritation. But for the most part it is improper to apply them till the vascular irritation has been got under by other means.

378. *Pulmonary consumption.*—Dr. Cullen marks this as a mere sequela of hæmoptysis, but it often commences, proceeds, and becomes incurably confirmed, without any spitting of blood; and often this last is rather an accompanying symptom than a preliminary condition of phthisis.

Symptoms—The first indication of this disorder is usually a short, dry cough, with impeded and hurried breathing, especially upon exercise either of the body or the lungs; an indolence and langour insensibly creep upon the patient's habits and feelings, and he is observed to lose flesh; he is more than commonly also sensible to alternations of temperature, and in this state, between positive health and actual disease, the patient will often continue for some length of time. But the breathing afterwards becomes more and more difficult; and the cough more decided; now too, pains are felt in the chest; a difficulty in lying on one side is experienced; the emaciation becomes more conspicuous, and hectic irritation is decidedly established; burning heats are felt in the palms of the hands and soles of the feet; the pulse becomes not only quick, but hard; the urine high colored, and throws down a branny sediment; and the tongue, from being at first covered with a whitish crust, now appears clear and red. The two daily exacerbations of the hectic fever occur; the face comes to be marked at the time with a circumscribed spot of red. Morning perspiration too, principally about the neck, head, and shoulders, comes to harrass the consumptive subject; and, at this stage of the complaint, the white of the eye assumes a pearly appearance, which is remarkably and mournfully opposed to the swimming brilliancy of its transparent part. Now too, the sputum has become unequivocally purulent; the stomach fails of its retaining power, even though the appetite may not be deficient; the emaciation becomes extreme; the cheek-bones frightfully prominent; the eyes hollow and languid; the nails incurvated; the hair falls off; œdematous swellings of the ancles take place, and at length, a diarrhœa occurs, which last is usually a prelude to speedy dissolution: and the patient often dies, while he is still full of hope with respect to his state, and planning schemes for his enjoyment in life. This last feature, however, is not an invariable one of the disease; in some cases, the patient is conscious of his approaching end, and resigned to his fate; at other times he wars against the disorder, and is worried by present irritation and gloomy prospects.

The above account of the progress of the disease we have taken, as we have many others, from Dr. Uwins's Compendium; but in the present instance we shall add the symptoms of pulmonary consumption from two other modern authors; for it is often useful to contrast and compare the accounts of different writers, and the student cannot take too much pains in familiarising himself with the physiognomy of this frequently occurring malady. The two other physicians from whom we now extract are Dr. Gregory and Dr. Thomas.

A slight tickling cough is one of the first symptoms that mark the formation of tubercles in the lungs. The patient is languid, and has the feeling of slight pains in some part of the chest, when he ascends a flight of stairs, or takes any considerable exercise. The pulse will commonly be found, even in this early period of the disease, somewhat accelerated. These symptoms, however, being very slight, are often overlooked, both by the patient and his friends, until the occurrence of hæmoptysis, which may be said to characterise the first stage of phthisis pulmonalis, with as much certainty as purulent expectoration does the second.

By degrees the cough becomes more and more troublesome. A fixed pain in some part of the thorax, or about the pit of the stomach, will now be complained of. Respiration is hurried, and the patient is unable to expand the chest, even in the slightest degree. There is difficulty in lying on one or other side, or sometimes on the back, and, at length, the nature of the disease is put beyond doubt by the occurrence of purulent expectoration, and hectic fever.

The expectoration of a thick pus, generally in the form of globular lumps, of a straw color, occasionally tinged with blood, and always more or less mixed with mucus, is indeed the peculiar feature of this disease; but perhaps too much stress has been laid upon the necessity of distinguishing in pulmonic diseases between the different kinds of expectorated matter. An extensive observation of disease will show that its appearance varies extremely, not only in different individuals, but even in the same individual on different days, and that its qualities may alter, without materially altering the danger, still less the nature of the disease.

Dr. Gregory goes on to describe the peculiarities of hectic fever, and then continues his history in the following manner:—

Such are the characters of hectic fever; and, as they are always most strikingly displayed in the progress of tubercular consumption, they will seldom fail, in conjunction with the local symptoms already enumerated, to afford evidence which will be sufficiently decisive of the nature of the disease. There are some symptoms, however, which occasionally occur in the progress of consumption, which require a separate notice. I may first mention that it is not uncommon to

have in this disease an accession of acute pleurisy, or of inflammation of the peritonæal surface of the liver. Further, as phthisis frequently supervenes on other diseases, its symptoms are sometimes so complicated with those of the primary disorder, that much discrimination is required in forming a judgment as to the true nature of the case. In many instances the symptoms of such diseases correspond very closely with those of phthisis, and this applies more especially to certain morbid states of the larynx and trachea, and to some obscure affections of the heart and great vessels.—I have already alluded to the hoarseness which attends consumption, and to that sympathetic affection of the larynx which is so frequent in its latter stages.

Dropsy, particularly of the cellular membrane, is by no means uncommon in this disease. A degree of œdema of the feet and ancles is sufficiently decisive of it, but it frequently extends also to the legs and thighs. This has commonly been attributed to debility, to that same relaxation of the capillaries to which we are in the habit of ascribing colliquative perspirations. But this theory is doubtful, because in many cases, where an equal or even a greater degree of muscular weakness prevails, there is no appearance of dropsical effusion. Dr. Hastings is inclined to attribute it to the mucous membrane of the bronchiæ becoming implicated in the disease.

Dr. Thomas says the incipient symptoms of phthisis will vary with the cause of the disease; but when it arises in persons of a strumous temperament, or from tubercles, it is mostly thus marked; it begins with a short dry cough that at length becomes habitual, but from which nothing is spit up for some time, except a frothy mucus that seems to proceed from the fauces. The breathing is at the same time somewhat impeded, and upon the least bodily motion is much hurried; a sense of straitness with oppression at the chest is experienced; the body becomes gradually leaner, and great languor with indolence, dejection of spirits, and loss of appetite prevail.

In this state the patient frequently continues a considerable length of time, during which he is, however, more readily affected than usual by slight colds; and, upon one or other of these occasions, the cough becomes more troublesome and severe, particularly by night, and is at length attended by an expectoration, which towards morning is more free and copious. By degrees the matter which is expectorated becomes more viscid and opaque, and now assumes a greenish color, and purulent appearance, being on many occasions streaked with blood. In some cases a more severe degree of hæmoptysis attends, and the patient spits up a considerable quantity of florid frothy blood.

The breathing at length becomes more difficult, and the emaciation and weakness go on increasing. With these the person begins to be sensible of pain in some part of the thorax, which, however, is usually felt at first under the sternum, particularly on coughing.

At a more advanced period of the disease a pain is sometimes perceived on one side, and at times prevails in so high a degree, as to prevent the person from lying easily on that side; but it more frequently happens that it is felt only upon making a full inspiration or coughing. Even where no pain is felt it often happens that those who labor under phthisis, cannot lie easily on one or other of their sides without a fit of coughing being excited, or the difficulty of breathing being much increased.

Dr. T. then goes on to notice the coming on of hectic, and proceeds to say, that, from the first appearance of hectic symptoms, the urine is high colored and deposits a copious branny red sediment. The appetite, however, is not greatly impaired; the tongue appears clean; the mouth is usually moist, and the thirst is inconsiderable. As the disease advances the fauces put on rather an inflamed appearance, and towards the termination are often beset with aphthæ, and the red vessels of the tunica adnata become of a pearly white (this last sympton and appearance is remarkably characteristic of phthisis). During the exacerbations a florid circumscribed redness appears on each cheek; but at other times the face is pale and the countenance somewhat dejected.

At the commencement of hectic fever, the belly is usually costive; but in the more advanced stages of it a diarrhœa often comes on, and this continues to recur frequently during the remainder of the disease; colliquative sweats likewise break out, and these alternate with each other and induce vast debility. The degree of heat in which the patient is kept has often a great effect upon the diarrhœa; for by exposing him to cool air in the morning the sweat may be much diminished, but the diarrhœa will be increased; and on the other hand, if the diarrhœa be relieved by opiates and astringents, the sweating will be aggravated; thus they frequently alternate for a long time, but in a few instances they are both severe at once.

In the last stage of phthisis the emaciation is so great that the patient has the appearance of a walking skeleton; his countenance is altered, his cheek bones are prominent, his eyes look hollow and languid, his hair falls off, his nails are of a livid color and much incarcerated, and his feet and ancles are affected with œdematous swellings. To the end of the disease the senses remain entire, and the mind is confident and full of hope. It is indeed a happy circumstance attendant on phthisis, that those who labor under it are seldom apprehensive or aware of any danger; and it is no uncommon occurrence to meet with persons, laboring under its most advanced stages, flattering themselves with a speedy recovery, and forming distant projects under that vain hope.

Shortly before death the extremities become cold. In some cases a delirium precedes that event, and continues until life is extinguished.

Causes.—Scrofula constitutes the predisposition to true or tubercular phthisis; a particular formation of the body likewise predisposes to it, as long neck, high shoulders, and narrow chest; which, when they occur with a scrofulous diathesis, give a manifest tendency to the production of phthisis. The exciting causes are cold, and every thing which may mechanically, as it were, injure the lungs, such as the occupations of

needle-pointing, flax-dressing, hair-powdering, &c. We are told by Dr. Willan that hair-dressers, bakers, masons, bricklayers' laborers, laboratory men, coal-heavers, and chimney-sweepers, as well as dressers in flax and feathers, and workmen in the warehouses of leather-sellers, are liable especially to pulmonary disease. It seems to a certain extent contagious. On the continent it is generally supposed very contagious, but in this country the opinion is generally scouted. Various diseases will excite the pulmonary tendency into action, as the catarrhal irritation of the exanthemata, especially measles; asthma, whooping-cough, bronchitis, pneumonia, hæmoptysis, will all and each of them occasionally come to be productive of suppurative lungs in the common way of inflammatory disorganisation, or will excite the tubercular predisposition into the specific disorder in question; for genuine phthisis, we may repeat, is invariably tubercular. Tubercles are small tumors, which have been supposed by some to be indurated lymphatic glands; but, although this is not the case, their formation and progress seem to have some intimate connection with the workings of the lymphatic system; they are at first indolent and harmless, but, becoming inflamed, they suppurate and form little abscesses, which communicating with the air-cells of the lungs, are discharged by expectoration. These bodies vary from the size of a pin's head to that of a garden pea; they are frequently formed through the whole substance of the lungs, but are most usually met with in its upper and posterior parts. In their earliest state they are solid and of cartilaginous hardness. No blood vessels can be traced in them even by a microscope, and the finest injection does not penetrate them. They are situate, not in the air-cells, but in the proper cellular texture of the lungs.

Distinctions.—In the latter stages of pulmonary consumption, the disorder is too unequivocally marked to be mistaken for any other. Chlorosis and amenorrhœa, however, simulate the disorder in its early stages, and often terminate in its actual production. In respect to the distinction between pus and mucus, the eye will soon, by use, learn to make it with quite as much accuracy as by any chemical tests; pus, it is merely necessary to say, is more compact in its substance, more opaque in its appearance, sinks sooner in water, and is of a more fœtid odor than mucus. When pus comes to be gradually formed from mucous surfaces, the discharge is often a something between mere mucus and positive purulent matter. This kind of intermediate substance is, however, more common to bronchitis than to tubercular consumption, and its presence may in some measure be taken as a diagnostic mark between the one and the other disease. Between specific or true consumption, and the disorders which commence in common inflammation, and in common suppuration, the distinction must be taken from the slow insidious progress of the former, and from its being accompanied by scrofulous marks. It may in conclusion be noticed that there is often a peculiar and semi sort of voice in the individuals destined to be consumptive, and not unfrequently actual aphonia occurs. The stethoscope has lately been employed by Dr. Davis for ascertaining the various stages of this disease. It was originally introduced by Laennec, and owes it power to the conducting power of a piece of wood which is brought in contact with the chest. By the sound emitted, the practitioner is enabled to determine the amount of the patient's danger.

Prognosis.—Always unfavorable in confirmed tubercular phthisis. We hear talk of ulcers being healed, and consumptive cysts left, as cysts are formed in the brain after hæmorrhagia cerebri, and the disorder thereby for a time stopped; but it is, to say the least, extremely doubtful whether strumous tubercular ulceration that has taken place to any extent can ever be cured either by nature or art. That pus may be expectorated, and the patient recover, we all know; but then this is the pus of common, not of specific inflammation, and takes place after bronchitis, or after pneumonia, not from tubercle. Dr. Gregory, in remarking on the prognosis in consumption, expresses himself in the following manner:—It is unnecessary to treat formally of the prognosis in this disease. The common observation of the world has sufficiently stamped its character as the most destructive disease in this island. (the annual deaths in England by consumptions are calculated at one in five of the whole mortality, and amount therefore annually to about 55,000), and in its confirmed stage almost hopeless. The duration of the complaint, however, it is scarcely possible to define with any degree of accuracy; for a galloping and lingering consumption are almost equally frequent. A French author, speaking of the usual duration of pthisis, informs us that, out of 200 cases, 104 died, within nine months. In many cases there are threatenings of the disease for several winters before the symptoms assume any degree of urgency. They are often checked by the return of mild weather; but perhaps, even in a still more remarkable manner, by pregnancy. The months of January and December are observed to be particularly fatal to phthisical patients. Sometimes they die from extreme weakness, exhausted by the discharge of pus, and the colliquative perspiration and purging; at other times more suddenly suffocated by accumulation of pus in the bronchi, which they are unable to expectorate; and in some rare cases by the rupture of a large blood-vessel in the lungs in consequence of ulceration.

Treatment.—Keeping down irritation constitutes the main principle in the management of phthisis, since it is irritation, superinduced upon predisposition, by which the disorder becomes developed; but then, in attempting to do this, we must recollect that there is often a formidably asthenic condition of frame, under the cover of high action, and that we may come to defeat our own purpose by pulling down too fearlessly. In the catarrhal irritation of incipient phthisis, small bleedings are, however, often imperatively demanded. Counter irritants are also called for, such as blisters, or the antimonial ointment to the chest. It is in this condition of parts and of the whole that the vegetable narcotics, viz. the digitalis, prussic acid, hyoscyamus, conium, and poppy separately, or some of them combined,

will be found applicable; and if the pulmonary excitement partake, notwithstanding its constitutional and specific nature, of a sympathetic character, or is magnified, if not made, by stomach and bowel, or hepatic disorder, then small doses of the blue pill, in conjunction with the narcotics, may be admissible. Gentle laxatives are always to be thought of as part of the curative measures; and some have much faith in the occasional, or even periodical, exhibition of emetics; these last have, however, for the most part been used in the latter or ulcerative stages of the disorder. Regulation of the diet, but more especially of external temperature, is, in the early periods of phthisis, of most important consideration. Warm clothing should be enjoined, especially warmth to the feet; and, when the menaces of the complaint are too unequivocal to be mistaken, we must give up all thoughts of braving it out, or hardening the frames of our patients, lest we add to the already existing irritation. Some, indeed, still pursue the plan, even in the most formidable state of consumptive manifestation, of cold applications to the chest, and other rough processes; and success may, occasionally, have followed their experiments: it must likewise be admitted, that the other plan of confinement and regulating temperature is but too often unavailing. While we keep the apartments of our consumptive invalid in a state of equable warmth, we must, at the same time, guard against those impurities in the air that are likely to be engendered by confining it; and we must at no time raise the heat beyond pleasant endurance. Early removai to more temperate climates, such as the south of France, or Devonshire, in our own country, may be thought of, when the patient's circumstances permit; but the idea of any specific good to be got by these changes, beyond a greater equality of temperature, must be given up. In some cases the journey or voyage may prove useful, by altering the actions of the system, and inducing a new series of movements. Inhaling tar vapor has been highly recommended, but it is for the most part too irritating, and rather applicable to bronchitis than to true consumption; a farinaceous diet should be enjoined, such as arrow-root and light puddings; milk, too, as being nutritious, without being irritating, ought to constitute a large portion of the phthisical patient's support; ass's milk, being more easily assimilated than that of the cow, is, in cases of weak digestion, more beneficial; but in no other way preferable. Shell-fish, especially oysters, seem sometimes abundantly to suit the consumptive. But these are matters that must be rather regulated by individual experience than abstract rule. All inhalations of factitious airs, whether to moderate the excitement of the first stages, or to stimulate and heal ulcers in the latter, are pretty generally now abandoned as unavailable. In that condition of phthisis which is between the hope of the first stage and the absolute hopelessness of the second, chalybeates have been employed with alleged benefit; especially the combination of myrrh, sulphate of iron and alkali, constituting the celebrated mixture of Griffith, and now introduced into the pharmacopœia, under the name of mistura ferri composita. This is especially applicable to the consumptive disorder of chlorotic females, and may, with address and management, be applicable to the states supposed. We do not, however, in the present day, find medicines of this class so available, or even so admissible, as the reports of our immediate predecessors would lead us to believe might be the case. Moderate exercise, so as to keep up a constant tendency towards gentle perspiration, should be enjoined on the consumptive invalid, when it can be used without too much exposure; horse-back exercise was formerly thought to be almost a specific in hectic irritation; swinging is recommended by some, upon the same principle of agitating and exercising without fatiguing. We come to be more and more sceptical with respect to the specific qualities of waters, as well as places, for consumptions. The Bristol waters, for instance, have been extolled and held in reputation as highly antiphthisical: but a practitioner of high name, and not certainly destitute of a disposition to credit remedial processes, and who resided at the hot wells, ridiculed their pretensions to sanative virtue; and another physician tells us, that during a residence of some time, at and near the Bristol hot wells, he cannot charge his memory with a single instance where any person, laboring under a confirmed phthisis, experienced much relief from their use alone.

In the confirmed, or completely suppurative, stage of the disease, it follows from what has been intimated above, that we are not to expect much from art; opening setons or issues in the fleshy parts of the chest may prove of temporary advantage in prolonging life; and should the purulent sputum not come from almost the whole mass of the lungs, or not result from turbercular irritation, this measure might, in some cases, prove radically and permanently sanative. British physicians of the present day look possibly with too little regard upon the power of these counter-irritants. When there is not such a degree of inflammatory irritation as to forbid their use, tonics of different kinds, especially the mistura ferri composita, may be given under these circumstances, and the copaiba may be tried, should we suspect that the purulent discharge was partly, at least, from the bronchial membrane; but it may be repeated, that, in true phthisis of a confirmed kind, it is idle to encourage the expectation of any radical or essential good being accomplished by our present knowledge of the powers of art.—*Dr. Uwins.*

Dr. Gregory's remarks on the treatment of consumption are as follows:—

It is melancholy to reflect how very little this disease is under the control of medicine; and, before I can enter upon the consideration of the principles which are to guide us in its treatment, I must record the failure of every plan for its effectual cure, which human ingenuity has yet devised.

The first principle which it appears to me of importance to inculcate is, that in phthisis active measures cannot be pursued, and that this must be compensated by a strict attention to a number of less circumstances, which in many other

diseases may be neglected without detriment to the patient. We are to bear in mind that consumption, though an inflammatory affection, is principally characterised by its occurring in a scrofulous, which is commonly a weak habit of body, and in an organ loaded with tubercles, the inflammation of which runs rapidly to suppuration. The chief objects of consideration, therefore, are how these tubercles may be either absorbed, or kept in a quiescent state; in what respect their treatment, when inflamed, differs from that of common pneumonia; and how the constitution may be best supported in the protracted suppuration to which their inflammation leads.

The question has been frequently agitated, whether tubercles can be absorbed, and by what medicines that desirable object can be effected. Emetics have been recommended by some, the muriate of baryta by others; but, though there is every reason to believe that tubercles have in some cases dispersed, yet this effect appears to be as completely out of our control, as the manner of their formation is beyond our knowledge. All that can reasonably be expected from medicine is to keep them in a quiescent state, and this is to be done by a strict attention to diet, air, exercise, and by avoiding all those causes which we noticed, in the last chapter, as likely to bring on hæmorrhagy of the lungs.

The diet of a person who has shown a disposition to phthisis, should be nourishing, and calculated to afford strength to the system, without creating a disposition to febrile excitement. For this purpose, farinaceous preparations of all kinds, with milk, should be recommended. Animal broths with fish and a proportion of plainly dressed meat may also be allowed; but all highly seasoned dishes, and food which is difficult of digestion, and fermented and spirituous liquors are to be strictly prohibited. Nothing appears more likely to correspond in every respect with this indication of cure, than the breathing a free and pure air, and its advantages in consumptive cases are generally acknowledged. The patient should be sent therefore to the country, and if possible a situation selected, which is sheltered from cold bleak winds, and where the soil is gravelly.

To those whose circumstances will admit of it, we should advise the removal to a warm climate. Consumption, though far from being uncommon in the southern countries of Europe, is, upon the whole, less frequent there than in cold climates; but between the tropics it is a disease nearly unknown. This consideration, were it not for the danger of the endemics of those countries, would induce us to prefer the Bermudas, or even the West India Islands, as a residence for consumptive patients. But even the south of Europe, particularly the climate of Naples, holds out many advantages, and a timely removal thither, with regularity of living, may be recommended to those who are threatened with consumption, with a fair prospect of overcoming the tendency to the disease.

With the enjoyment of a free and pure air, moderate exercise should also be advised. A sedentary mode of life, and close application to study, or business, have frequently proved the exciting cause of the disease; partly, perhaps, by the bent position in which the thorax is so long kept, but principally from the want of that due exercise which is essential to the preservation of the health and strength of the body. With the view of affording at the same time, both exercise to the body and relaxation to the mind, a journey during the summer months is particularly useful.

When hæmoptysis has occurred, and when the symptoms warrant the belief that inflammatory action is going on in the lungs, measures of more activity must be pursued. Bleeding from the arm has been recommended as a means of putting an immediate check to the progress of the disease; but this is a vain hope, and blood-letting must therefore, at all times, be resorted to with caution, and a due consideration of the habit of body in which consumption occurs. Where the pulse is hard and contracted, and the pain and cough urgent, blood must be drawn from the arm as in pneumonia, and repeated according to the strength of the habit, and severity of the symptoms. At any period of the disease, if pleuritic symptoms supervene with a loaded state of the tongue, blood may be taken away; and commonly a few ounces taken from the arm will be preferable to the application of leeches.

Blisters afford great relief to the cough and tightness across the chest, and they may be repeatedly applied with great advantage through the whole course of the disease. I have never seen sufficient benefit derived from issues and setons to warrant me in recommending them. Active purging is inadmissible, but an occasional dose of castor oil, or of rhubarb, will be found very useful. The mild diaphoretic and expectorant medicines may be exhibited frequently through the day. Attention to the state of the skin, indeed, is very necessary in this disease, as in every other in which the lungs are implicated. A uniform temperature of the body should be promoted by warm clothing. In some cases it may be necessary, during the whole winter, to confine the patient to apartments which are of a regulated temperature.

In this state of disease digitalis is universally employed. That its powers have been extravagantly over-rated, I cannot doubt, but it appears in some cases to quiet the cough, and to be a useful narcotic. In this view, I am inclined to think it preferable to conium, and even sometimes to opium. I have never observed any good effect to follow from pushing the dose of this medicine to such an extent as materially to affect the pulse.

In the confirmed stages of consumption, it will be advisable to support the strength of the system by mild tonics; and the mistura ferri composita, in doses proportioned to the state of the system, is perhaps, under all circumstances, the best form of tonic which can be recommended. In many cases, however, it seems to increase the febrile excitement, and to aggravate the cough and dyspnœa.

Attention must chiefly be paid in this state of the disease to palliate the urgent symptoms. Cough may be alleviated by demulcents; diar-

rhœa may be diminished by chalk, catechu, and aromatics. Both these objects will be promoted, and the further advantage gained of procuring sleep, by the last resource which the art of medicine affords—opium.

In addition to the statements of the above mentioned physicians respecting the curative plans indicated in consumption, and the prospect of good from them, we shall here extract that part of Dr. Thomas's chapter on this subject which relates to change of air and climate.

In our climate, tubercles are evidently induced and accelerated in winter, and retarded in summer. A person gets a dry cough in winter or spring, which goes off as the summer advances, and was regarded as a catarrh, but tubercles were forming: if therefore such a person could be removed to a warm climate, before the winter comes on, he might escape an attack at this period; and, by continuing there for a few years, may be perfectly recovered. Going to a warm climate is not merely avoiding what might be hurtful, it is applying a remedy which has the best chance to prove beneficial.

It may justly be admitted, that the cold and variable temperature of the winters in England is the great source of phthisis in this country, and, when the disorder is once formed, greatly contributes to its fatal termination; and that a warm and equable temperature in some measure prevents the formation of the disease, and, when it has taken place in only a slight degree, possesses some power in retarding its progress.

In the early stage of consumption, that is to say, when suppuration and ulceration have not yet taken place, it appears from the report of Sir James M'Gregor, that the disease was checked by the climate of the Peninsula among those of the army affected with phthisis; but that when suppuration and ulceration had taken place, it ran even a more rapid progress than in England, and the same remark has been made in regard to the East and West Indies.

It is indeed a well-established fact, that a warm climate is only advantageous in cases of incipient phthisis. Persons who have passed the first stage of pulmonary consumption will derive no benefit from a journey to the South of Europe, or elsewhere. Those who labor under confirmed phthisis should never quit their own country. By leaving it, they will lose many comforts; they most probably will be deprived of the attendance of their nearest and dearest friends, as well as that of the medical men in whom they can place confidence, as the English are apt to be prejudiced against foreign physicians: they will, moreover, expose themselves to much anxiety and fatigue, and all this for a vague hope of recovering or prolonging life, an expectation very seldom, if ever, realised. If they remain at home, which they had best do, in all cases of confirmed phthisis, they may live throughout the winter in a regulated temperature.

If the patient's case is one of incipient phthisis only, and his circumstances will admit of removing in due time, that is to say, on the first threatenings of the disorder, from this climate to one in which the temperature is warm during winter, he may comply therewith. The islands of Madeira and Malta, Lisbon, Italy, or the south of France, have been recommended as proper places.

To persons liable to catarrhal or consumptive complaints, the most important properties of the climates of other countries are, warmth and equability of temperature, especially in the winter months. The islands of Madeira and Malta present, numerically, a mean temperature for the winter months, but Pisa, Nice, Villa Franca (very near the latter), and Hieres, are certainly the most desirable places for an invalid.

A female writer of some celebrity informs us, she is convinced by experience, that the lives of many consumptive patients might be saved were they sent by sea to Leghorn, advised to winter at Pisa, cautioned against travelling much by land, and, above all things, interdicted from crossing the Appennines and Alps, which people very frequently do, in order to spend the summer months in Switzerland, one of the most unequal climates in Europe. She thinks that, in pulmonary complaints, Pisa is entitled to a decided preference over Nice, Massa, Florence, Rome, or Naples, or indeed to any other place in Europe, from the beginning of October till the end of April. She was advised to travel over land to Italy, and, therefore, she passed over to France. Nice was recommended to her as the best winter climate, and she therefore spent many months in that city: but experience soon convinced her that she might have adopted a more eligible plan; for long journeys over land on the continent are to consumptive persons dangerous experiments, owing to the accommodations being so very indifferent that it is scarcely possible for an invalid to sleep at an inn out of a great town without suffering. To consumptive persons, and invalids in general, she therefore recommends the going to Italy by sea in a vessel bound to Leghorn, and so wintering at Pisa.

When the patient's circumstances or business will not admit of his removing to a more temperate climate, he must endeavour to pass his winter in some place which is dry and well sheltered from cold bleak winds, where the air is free and pure, and the soil of a gravelly nature. The mild and sheltered vales of Devonshire, but more particularly Sidmouth, Torquay, and Penzance in Cornwall, offer desirable situations of this nature; but the latter may be considered as entitled to a decided preference.

It has indeed been thought by some as equal to any situation abroad; and, therefore, the victim to consumption will not find it necessary to fly an exile from his home and friends to seek a doubtful advantage in a foreign clime.

From a register of the weather at Penzance, by Dr. Forbes, the mildness and equability of the temperature of that country are evident. He observed the maximum temperature of July was only 78° of Fahrenheit, the minimum of December only 33°, and the mean range of the barometer 1·48 inches.

With the enjoyment of a free and pure air, the patient should take daily moderate exercise either in a carriage or on horseback, but more

particularly the latter. By taking it in progressive journeys through different parts of the country, in fair and settled weather, the efficacy of the remedy, great as it may be at other times, would be much increased; for in such a tour the mind would find an ample store of amusement, and be diverted from any train of unpleasant thought. The pursuit of some object at the same time might probably add to the effect. All violent exertions, such as dancing, &c., liberties in diet, and going to crowded public places, are most cautiously to be avoided.

If the disease has made considerable progress, and the patient is thereby prevented from exposing himself out of doors during the winter and spring, he must be contented to live in chambers subject to very little change from the atmosphere, and heated from 62° to 65°, which temperature will be most suitable. A stove may be employed for the purpose, and a preference should be given to one of porcelain (like the German and Russian stove), over one of iron, as a very unpleasant smell is occasioned by the latter. Dr. Buxton is of opinion that in the common shop stove, or ironing stove used in laundries, we possess all that is necessary for the purpose of the proposed remedy.

Under the principle of amusing the mind, and at the same time of having a desirable end to be obtained, many phthisical patients are yearly sent to the hot-wells at Bristol. The waters of these wells have long been extolled for their supposed good effect in consumptive cases; but in my humble opinion they are by no means deserving of the credit ascribed to them, as, during a residence of some time at and near these wells, I cannot charge my memory with a single instance where any person laboring under a confirmed phthisis experienced much relief from their use alone.

That many persons who have been of a phthisical habit have derived benefit from resorting to the Bristol hot-wells, I am ready to admit; but this should not be attributed wholly to the waters. The horse exercise, which is taken daily by such patients, on a fine airy down, where most beautiful views and rich landscapes are presented to the eye on every side; the salubrity of the air; the heathfulness of the situation, and the frequent attendance on the different amusements which are furnished at these wells, and those of Clifton, prove beyond all doubt most powerful auxiliaries. Places of public resort are food to the mind of convalescents, and serve to keep it in the same active state that exercise does the body, preventing thereby that indulgence in gloomy reflection, to which the want of cheerful scenes and agreeable company is apt to give rise in those who are in an indifferent state of health.

The opinion which I have here offered, on the efficacy of the Bristol hot-wells waters, seems however by no means to accord with that entertained of them by a gentleman who some time ago published a dissertation on their chemical and medical properties. On the subject of pulmonary consumption, he observes, that the utility of a journey to Bristol, undertaken while a cure is yet practicable, is demonstrated by hundreds of examples annually, where the disease is prevented in many, and suspended or mitigated in others. I agree, however, with Dr. Beddoes, that the fine things which medical men put into their pamphlets about the water of the places where they constantly or occasionally reside, are to be received with a large share or weight of allowance. Nay, I am decidedly of opinion, that at least three-fourths of the cures attributed to all mineral waters, ought rather to be placed to the account of a difference in air, exercise, diet, amusement of the mind, and the regulations productive of greater temperance, than to any salutary or efficacious properties in the waters themselves.

Short voyages on sea have been much recommended to consumptive persons, under the idea that sailing is of all modes of exercise or conveyance the smoothest and most constant. The good effects produced by sea voyages seem to depend, however, chiefly on the purity of the air, assisted somewhat probably by the occasional vomiting, which persons unaccustomed to be on board of a ship usually experience.

379. *Hæmorrhoids.*—Hæmorrhoids are either formed of varicose hæmorrhoidal veins, or of parts of the internal membrane of the rectum strangulated by the contraction of the sphincter ani, or of interstitial deposits of blood in the cellular membrane of the part under the mucous coat of the intestine. They are divided into external and internal, blind and bleeding, and the differences may be easily understood from their names. They are frequently accompanied by much heat and pain about the loins and in the rectum, which is increased often by the passage of the fæces; when the pile becomes inflamed, and is in this condition strangulated by the sphincter, and the pain which they occasion is often of the most acute kind. When the piles bleed, they frequently do so most profusely, so that the quantity of blood lost in this way will be very considerable.

Causes.—A predisposition to piles is often increased by too free an indulgence in food and wine, by sedentary habits, by suffering the bowels to remain long in a costive state, by the too frequent use of the resinous purgatives, particularly aloes, which seem to have their influence principally directed upon and confined to the lower bowels, by any long continued posture, particularly of sitting too much; and they have occasionally been engendered by riding on horseback. All circumstances which interrupt the free return of blood from the large veins of the abdomen, conduce to hæmorrhoids; hence they are of common occurrence in pregnancy. Persons too with diseased liver are very obnoxious to piles.

Prognosis.—Piles in themselves are seldom attended with much danger, in fact they have been considered as rather salutary occurrences than not, and in some cases they may actually prove so; thus apoplectic tendencies may be suspended by the appearance of the hæmorrhoidal discharge, and other affections may also be diverted or arrested by the vicarious action of hæmorrhoids. Their dangerous tendency consists in the establishment of a permanent thick-

ening of the intestinal membranes, or in their exciting inflammation which shall extend through the cellular membrane, terminate in abscess, and be productive of sinuous or fistulous sores.

Treatment.—The doctrine of active and passive hæmorrhage is especially requisite to attend to in reference to the hæmorrhoidal affection, which, according to the presence or absence of high irritation, demand opposite modes of treatment. When the pain and swelling is considerable, in case of blind piles, it is often necessary to abstract blood, sometimes from the system generally, or rather by the arm; but oftener it will be proper to apply half a dozen leeches locally about the verge of the anus, and to administer saline or refrigerant purgatives. But, for the most part, the best purgatives are sulphur, senna in the form of the confection, castor and linseed oils.

℞ Confect. sennæ,
Sulphuris loti āā. f. ℥i.
Syrup. q. s.

Fiat elect.: sumat coch. ij. parv. nocte maneque.

Take of lenitive electuary and washed sulphur of each an ounce, simple syrup as much as will make an electuary. Let two tea spoonsful be taken night and morning.

℞ Olei lini,
Tincturæ rhei āā ℥ij.
Aquæ menthæ pip. f. ℥iv.

Fiat mistura. Sumat coch ij. magna bis in die.

Take of cold-drawn linseed oil and tincture of rhubarb of each two fluid ounces, peppermint water four fluid ounces. Make a mixture, of which two table spoonsfuls may be given twice a day.

℞ Pulv. potassæ nitrat. ℈ß.
Sulphuris loti ℈ßij.

Fiat pulv. ter in die sumendus.

Take of powdered nitre ten grains, and washed sulphur two scruples and a half. Make them into a powder to be taken two or three times a day.

Cooling lotions are sometimes required, such as half a drachm of white vitriol to half a pint of water; and when the piles are blind or no blood is discharged, but the pain and tension are considerable, the patient will often find much relief by sitting over the steam of hot water. But for the most part a horizontal position is desirable, and lying on the stomach will sometimes afford relief, probably by facilitating in some measure the return of the blood through the abdominal veins.

When the hæmorrhoidal flux is vicarious of constitutional or other irritation, especially when it occurs in a habit the tendency of which is unequivocally gouty, we must be careful of too precipitately stopping the discharge by astringent applications; and, where much debility prevails, the very same kind of medicines will cure which would at times create the disorder. The tincture of muriated iron, in doses of fifteen or twenty drops, will sometimes do much good in mere asthenic or passive hæmorrhoids, and steel is sometimes found to produce the disorder. In long standing hæmorrhoids, when ulcerative inflammation and fistula are threatened, the paste of Ward is occasionally of unequivocal service; so much so, that he who should refrain from prescribing it, because its operation seems to be inconsistent with the demands of the case, would be sacrificing his patient's good to theoretical niceties. This celebrated paste is composed of black pepper, and elecampane root, of each half a pound; fennel seeds and honey, of each one pound. The dose being the quantity of a nutmeg two or three times a day. Small doses also of copaiba balsam prove availing under the same circumstances. The dose may be about twenty drops or fifteen minims rubbed down with yolk of egg or mucilage of gum arabic.

380. *Immoderate flow of the menses.* Menorrhagia.

Symptoms.—Profuse menstruation, and immoderate discharges of blood from the uterus, are in some measure different disorders, since the menstrual secretion and discharge is not blood, being wanting in some of the characteristics of that fluid (See Physiology). Profuse menstruation is also rather relatively than positively a disordered state, since the natural quantity in different women, and even in the same woman at different times, varies very considerably. This discharge may further occur, like all other hæmorrhagic affections, in precisely opposite states, both generally and locally; and all these particulars, of course, require recognition by the medical practitioner. Unless, then, exhaustion takes place from the profuseness of the discharge, or from its occurrence when the female is very low and weak—or, on the other, high irritation, pain, and sympathetic fever, be excited, the case scarcely demands the interference of art.

Causes.—Predisposition to menorrhagia may be constituted by a full plethoric habit, and early sexual propensities—or the disposition to the passive form of the complaint may consist in a habit entirely the reverse, with a lax state of the uterine vessels. The exciting causes are, violent exercise, especially of dancing or walking much; much costiveness, producing exertion in the expulsion of the fæces; exposure to excessive heat; inordinate indulgence in venery, especially at the period of the menstrual flux; violent agitations of mind; repeated miscarriages; and, lastly, organic disorders of the womb, which by absorbing, as it were, the terminal arteries, which open out into the womb, occasion rushes of blood of an alarming nature; and in these cases the menorrhagia is accompanied often by very violent pain. Indeed, structural disorders of the womb, connected with discharges, are among the most formidable and distressing disorders to which the human frame is liable.

Prognosis.—It is not often that the mere discharge occasions a fatal termination, and, when the patient is without structural disorder to occasion the flux, the prognosis is for the most part favorable. Its frequent recurrence, indeed, exhausts the powers and gives accession to dropsical and other diseases, but otherwise menorrhagia is not to be considered as an affection of a formidable nature.

Treatment.—When the action is considerable and the sympathetic fever runs high, blood-letting may be called for; but it is not often that depletion to any great extent is either required or admissible. When much pain accompanies the discharge, cupping on the loins may be productive of considerable advantage. A light diet must be enjoined, and purgatives administered.

℞ Infusi rosæ f. ℥iß.
Magnesiæ sulphat. ʒiß.
Acid sulphur. dil. ♏ xv.
Syrupi papav. f. ʒßi.
Fiat haustus.

Take of infusion of roses a fluid ounce and a half, Epsom salts a drachm and a half, diluted sulphuric acid fifteen minims, syrup of white poppy a fluid drachm and a half. Make them into a draught.

The above formula will abate irritation, prove refrigerant, and act gently as an astringent. When the discharge is more passive or asthenic, the tincture of muriated iron, in doses of fifteen drops in a glass of water, may be given; or the tincture of catechu may be combined with the sulphuric acid, the dose being a fluid drachm of the former to fifteen or twenty drops of the latter. The acetate of lead may be administered in doses of a grain, with half a grain of opium made into pills with crumb of bread; in cases where the discharge is protracted and obstinate, and much enfeebles the patient, applications to the perinæum and hypogastrium of linen rags that have been dipped in vinegar may be had recourse to. Some recommend the throwing up into the rectum cold water, in which some common salt has been dissolved: and cold injections of alum or white vitriol dissolved in water, into the rectum, are in use. In all cases of active menorrhagia the patient should be as much as possible in a lying position, with the thighs rather raised above the horizontal line. Sponges dipped in cold and astringent lotions, and applied externally, will often supersede the necessity of injections. Whey, made by throwing a piece of alum into boiling milk, so as to coagulate it, will often prove a useful drink in menorrhagic disorder.

381. The *menorrhagia alba*, or *fluor albus*, or whites, is a very common and sometimes a very troublesome affection. It is sometimes an attendant upon menorrhagia and sometimes occurs exclusively of this last, occasionally attended by febrile excitement, but more commonly connected with general and local weakness. When this last is the case, tonics and stimulants are demanded; and, among the most efficacious of these, the warm balsams, particularly the copaiba and the tincture of cantharides may be reckoned; both these medicinals will occasionally in the first instance increase the discharge by giving a stimulus to the uterine vessels and general system, but eventually they will prove astringent. The muriated tincture of iron also often proves highly beneficial in asthenic fluor albus, and the uva ursi may occasionally be employed with advantage. Astringent injections in obstinate cases may be thrown up the vagina; but these are for the most part unpleasant to use, and difficult in their management; and the complaint being moreover for the most part quite as much of a general as of a topical nature, the internal medicines are those from which most benefit is to be expected.

Prescriptions.

℞ Tincturæ cantharid. ♏ xv.
Sp. ætheris nitric. f. ʒj.
Aquæ puræ f. ℥iß.
Fiat haustus.

Take of tincture of cantharides fifteen minims, spirit of nitric ether a fluid drachm, water a fluid ounce and a half. Make them into a draught.

℞ Copaibæ ♏ xxv.
Mucilag. acaciæ f. ʒiij.
Terantur simul in mortario sensim affundens aquæ puræ f. ℥iß
Dein add. sp. etheris nitric. f. ʒj.
Fiat haustus.

Take of copaiba balsam twenty-five minims, mucilage of gum arabic three fluid drachms, let them be rubbed together in a mortar by degrees, pouring on them a fluid ounce and a half of water; then add a fluid drachm of spirit of nitric ether, and make them into a draught.

℞ Uvæ ursi, fol. ʒiij.
Aquæ bullientis Oj.
Fiat Infus.

℞ Infusi istius frigefact. et colat. ℥iß.
Pulv. potassæ nitrat gr. viij.
Fiat haustus.

Take of the leaves of bear berry three drachms, boiling water a pint; let them stand to infuse. Of this infusion cooled and strained take a fluid ounce and half, and mix with it eight grains of powdered nitre, so as to make a draught.

When much pain or irritation connects itself with the discharge, the addition of twenty or thirty minims of the tincture of henbane may be attended with benefit.

It is always necessary, while these astringents and stimulants are employed, to preserve the bowels free by aperient medicines, for the discharge will sometimes be kept up by a constipated state of the intestines.

When this discharge is accompanied by irritation and excoriation it often excites alarm, especially in newly married women, on the score of suspected infection; and it is not seldom that the acrimony accompanying this irritative kind of leucorrhæa is such, that a degree of infection is imparted to the husband, and suspicion, or at the least very uncomfortable feeling, will on this side attach. The physician and surgeon will often be consulted on account of these distressing and delicate occurrences, and he ought to be careful of drawing a hasty inference merely from the circumstance of communication of disorder. The respectability of the consulting parties constitutes for the most part a sufficient guarantee against any thing improper, and, if there be any doubt as to the nature of the discharge, it is often ascertainable whether the disorder be merely fluor albus or venereal gonorrhœa by the absence in the former case of that ardor urinæ which almost invariably attends the latter.

Vomiting of blood (hæmatemesis). Discharges

of blood from the kidney (hæmaturia), and discharge of blood from the bladder (cystirrhagia), are not reckoned among the genera, in the nosology, because they are considered by Cullen as for the most part, if not always, symptomatic.

382. *Vomiting of blood.*

Symptoms.—The connecting symptoms are a sense of weight and uneasiness about the præcordia, which indeed is for the most part some time existent prior to the discharge, and is relieved by the discharge.

Causes.—The discharge is for the most part occasioned by obstructions in the liver, or the spleen, and sometimes is the consequence of suppressed hæmorrhoidal or menstrual flux. Merely constipated bowel will at times produce hæmorrhage from the stomach where there is a constitutional disposition to its occurrence. It is often brought on by blows on the stomach, and sometimes occurs as a consequence of vascular debility engendered by the habits of spirit drinking.

Distinctions.—The blood discharged from the stomach is for the most part much more dark, grumous, and clotted, than that which comes from the pulmonary vessels; it is also usually thrown up in much larger quantities—part of the stomach's contents are not seldom mixed with it, and it produces much more exhaustion at the time than hæmoptysis. It also for the most part takes place in constitutions that have been injured by other disorders, and is preceded as above remarked by præcordial oppression more signally than in the instance of hæmoptysis. (See *Hæmoptysis*).

Prognosis.—It is of a more dangerous nature as to its immediate effect, than hæmorrhage from the lungs; but even here it is rather from the discharge being a manifestation and effect of disordered viscera and broken down stamina, than from the mere quantity of blood thrown up, that a fatal event is to be apprehended.

Treatment.—Whether depletion is to be employed in this disorder depends upon the age and constitution of the patient; and the same remarks apply as in other cases of hæmorrhage. For the most part, however, the habit is too feeble, and the constitution too much shattered to admit of much blood-letting. Purging is almost invariably necessary, and castor oil or Epsom salts should be employed for this purpose. After the bowels have been freely evacuated, astringents may be administered as in hæmorrhages; and in obstinate cases the acetate of lead may be employed. See *Hæmoptysis* and *Menorrhagia.*

383. *Hæmorrhage from the kidneys or bladder.*

Symptoms.—Pain in the loins or above the pubis, and occasionally a difficulty, especially in the first efforts, to discharge the urine.

Causes.—Calculous and other foreign bodies, in the kidneys or bladder, will give rise to the disease; but sometimes the discharge seems to be a sort of plethoric manifestation, the urinary organs being made use of, as it were, by nature, to convey away redundant blood. It sometimes follows violent blows or strains, and is occasionally the result of common inflammation in these very vascular parts.

Distinctions.—The very high-colored urine, occasioned by an admixture of bile, or other disordered states of the kidney or general system, does not stain linen of a red color, as is the case in hæmaturia; nor, in the former instances, is a red coagulum thrown down to the bottom of the vessel.

Prognosis.—When the affection is unaccompanied by any indication of organic disorder, in the parts from which the discharge proceeds, the prognosis may be considered favorable. But these discharges are seldom thus idiopathic, and the degree of danger must be inferred from the degree of the producing derangement.

Treatment.—Saline purgatives, with syrup of poppies, as in the hæmoptysis. If calculus is present, mucilaginous drinks and medicinals will be demanded, such as large draughts of barley water, with tragacanth or acacia gum, mixed in it. Decoction of marsh mallows. The tinctura ferri muriatis, in cases of much weakness, will be found useful. Uva ursi has long had a reputation in urinary discharges.

℞ Uvæ ursi foliorum ℥ß.
Aquæ ferventis Oj.
Fiat infusum.

℞ Hujus infusi frigefacti et colati f. ℥vii.
Pulveris potassæ nitratis ʒj.
Syrupi papaveris f. ℥j.
Fiat mistura. Dosis pars sexta.

Take of bear berry leaves half an ounce, boiling water a pint. Make an infusion; of this infusion take seven fluid ounces, powdered nitre a drachm, syrup of poppy a fluid ounce. Make them into a mixture: the dose is the sixth part.

The peach leaf has been employed with alleged success in obstinate hæmaturia.

℞ Persicariæ foliorum exsiccatorum ℥j.
Aquæ puræ Oij.
Decoque ad Oiß; liquore frigefacto, coletur; bibat æger Oj. in die.

Take of dried peach leaves an ounce, water a quart; boil down to a pint and a half; when the liquor is cold strain it, and let a pint be taken in the course of the day.

Oil of turpentine, in small doses, is occasionally employed in hæmaturia of long standing.

℞ Olei terebinthinæ ♏ xxv.
Mucilaginis acaciæ f. ʒij.
Syrupi papaveris f. ʒj.
Aquæ puræ f. ℥iß.
Fiat haustus: nocte maneque sumendus.

Take of oil of turpentine twenty-five minims, mucilage of gum arabic two fluid drachms, syrup of white poppy one fluid drachm, water a fluid ounce and a half. Make a draught, to be taken night and morning.

384. Order V. Fluxes. Profluvia. Catarrh.—The symptoms of catarrh, or as it is vulgarly called cold, need scarcely be mentioned beyond what are comprised in the definition. The causes are said to be cold and contagion; it is probable, that a degree of contagion connects itself with all catarrhal affection, for you never see one child in a nursery affected by a cold, without the affection reaching the other children of the same family; the difference between the influenza or contagious catarrh of Cullen, and common cold, is probably referrible to the state of the air; and the division should

be into infectious and common, not into contagious and ordinary catarrh.

Prognosis.—Catarrh only, then, becomes dangerous, when it happens to meet with disordered predisposition; thus, that inflammation of the mucous membrane of the nostrils, &c., by which it is constituted, may become protracted and extended down into the bronchial cells, and thus form bronchitis; or it may excite the tubercular latency into action from contiguity and sympathy, and thus come to be productive of true consumption; or it may prove an excitant of asthmatic disposition, or fall into common pulmonary inflammation: but in all these cases the disorder, before it is dangerous, becomes, nosologically, a new affection.

Treatment.—Catarrhal irritation is to be allayed by aperients, diaphoretics, and demulcents, according to the degree of excitement, and accompanying hoarseness or cough.

℞ Potassæ nitratis ℈ß.
Misturæ amygdalæ f. ℥iß.
Syrupi tolutani f. ʒij.
Fiat haustus

Take of nitrate of potass (nitre) half a scruple; almond emulsion a fluid ounce and a half; syrup of tolu two fluid drachms. Make a draught.

℞ Syrupi papaveris f. ʒij.
Spiritus ætheris nitrici f. ʒj.
Mucilaginis acaciæ f. ʒiij.
Aquæ puræ f. ℥iß.
Fiat haustus.

Take of syrup of white poppy two fluid drachms, spirit of nitric ether one fluid drachm, mucilage of acacia three fluid drachms, water a fluid ounce and a half. Make them into a draught.

℞ Pulveris inulæ,
Sulphuris loti,
Pulveris radicis glycyrrhizi, āā ℥ß.
Mellis despumati q. s.
Fiat electuarium: cujus sumat æger cochleariuum unum parvum subinde.

Take of powder of elacampane, of washed sulphur, and of liquorice root, of each half an ounce; honey enough to make an electuary. A tea-spoonful to be taken frequently.

℞ Oxymellis scillæ f. ʒj.
Syrupi papaveris f. ʒiß.
Spiritus ætheris nitrici f. ʒj.
Misturæ ammoniaci,
Aquæ puræ, āā f. ʒvi.
Fiat haustus.

Take of oxymel of squill a fluid drachm, syrup of white poppy a fluid ounce and a half, nitric spirit of ether a fluid drachm, ammoniacal mixture and water of each six fluid drachms. Make a draught.

The last as an expectorant after the inflammatory symptoms have subsided.

385. *Dysentery.* Dysenteria.

Symptoms.—Dysentery sometimes appears, in the first instance, in the form of a purely local disease; and, in that case, the pyrexial symptoms are not manifested till after the griping and tenesmus, and mucous and sanious discharges shall have occurred; sometimes the disease is ushered in by pyrexial irritation, loss of appetite, nausea, flatulency, and frequency of pulse. With the mucous and muco-sanguineous discharges are sometimes passed indurated knotted masses of fæcal matter, called scybala; and the disorder sometimes rises to such a height, or continues for such a length of time, as to produce bearing down of the intestinal membrane; great prostration of strength; falling away of flesh; hiccough; and a fatal termination. At other times the disease will produce chronic affections of the parts implicated, which will last for months, and the patient eventually recover.

Causes.—Every thing which tends to derange the regular functions of the intestinal canal may tend to induce dysentery. It has at times been completely formed from the cretaceous mixture given injudiciously for diarrhœa. Obstructed perspiration, damp air, unwholesome diet, may occasion it; and, like most other disorders, it will prove communicable or contagious, under circumstances fostering such tendency.

Its proximate cause, as pathologists express themselves, is constituted of a mixture of inflammatory action in the villous coat of the large intestine, giving rise to irregular contractions of the gut; locked-up or morbid secretions; and all the consequent disturbance.

Prognosis.—The favorable signs are, a tendency to general diaphoresis; while the urine throws down a sediment, and the stools gradually acquire their natural color and consistence: the unfavorable symptoms are, dryness and contraction, alternated with clamminess of the skin, the pyrexial irritation continuing; the abdomen becoming tense; the tenesmus becoming more urgent; the pulse weak and irregular; the extremities cold, and hiccough and aphthæ making their appearance; while the disease shall become complicated with others, such as ague or hepatic disorders.

Treatment.—The dysentery that is met with in this country does not commonly require the use of the lancet; if, however, the irritation runs up very high, blood-letting, both general and topical, may be occasionally and under due restriction employed; the great objects of treatment are, to get completely rid of the scybala, and to keep under the inflammatory irritation and spasmodic contraction of the colon. An emetic, composed of ipecacuanha and antimony may be premised. Of cathartics, which are indispensable in dysenteric affections, the castor oil is the best; it seems, as it were, made for the complaint; and should be given in half-ounce or ounce doses every day, or twice a day, till the whole scybalous matter is brought away. The oleum lini and tinctura rhei, as recommended for hæmorrhoids, will often be found of service. When refrigerant or saline cathartics are employed (and these seem called for when the marks of inflammatory irritation run high), they should be combined with manna.

℞ Magnesiæ sulphatis ℥iß.
Mannæ ʒiij.
Aquæ menthæ piperitæ ℥ß.
Fiat haustus.

Take of Epsom salts half an ounce, manna three drachms, peppermint-water a fluid ounce and a half. Make them into a draught.

Emollient clysters are occasionally called for, with or without opium, according to circumstances.

℞ Decocti amyli Oj.
Tincturæ opii f. ʒj.
Fiat enema.

Take of decoction of starch a pint, tincture of opium a fluid drachm. Make them into an enema.

To allay irritation, a combination of ipecacuan and opium, as in the pulvis ipecacuanhæ compositus, constitutes one of the best of medicines.

℞ Pulveris ipecacuanhæ compositi gr. vj.
Confectionis aromaticæ q. s.

Fiant pilulæ duæ: ter quaterve in die sumendæ.

Take of compound ipecacuan powder six grains, aromatic confection enough to form two pills: to be taken three or four times a day.

Warm fomentations and stimulant embrocations to the abdomen will sometimes be found serviceable; and it will be expedient occasionally to rub the abdomen all over with castor-oil, as recommended in enteritis, by which, it appears that the expulsion of the scybala will be considerably expedited.

When the hardened fæces are all expelled, and the inflammatory and spasmodic irritation are got under, tonics are called for; and one of the best of these is the calumba, which may be given united to rhubarb.

℞ Infusi calumbi,
Infusi rhei, āā f. ʒvj.
Tincturæ cardamomi compositæ f. ʒj.
Fiat haustus.

Take of infusion of calumba and rhubarb of each six fluid drachms, compound tincture of cardamons a fluid drachm. Make them into a draught.

When opiates are still required, the confectio opii of the Pharmacopœia is one of the best forms in which to administer it.

℞ Confectionis opii gr. xv.
Vini ipecacuanhæ ♏ xv.
Aquæ menthæ piperitæ f. ℥iß.
Fiat haustus.

Take of opiate confection fifteen grains, ipecacuan wine fifteen minims, peppermint water a fluid ounce and a half. Make a draught.

The infusion of cusparia, or simarouba, or cascarilla, may be used in conjunction or alternation with calumba; but, upon the whole, the last mentioned bitter seems the best adapted for that intestinal weakness that has been brought on by protracted bowel disorder. When small points of ulceration have established themselves on the membrane of the intestine, giving rise to purulent discharge, chronic irritation, and hectic wasting, the vegetable narcotics are to be had recourse to, with small quantities of the blue pill. When the liver has had to do with the origin of the disorder, or takes on a decidedly disordered action during its course, mercurials in a large dose will be required; and in all cases we must be careful not to push our tonics, under the notion of debility, while the secretions continue obstinately out of order. The copaiba balsam, combined with one or other, or more than one, of the vegetable narcotics, will occasionally prove advantageous in old dysenteries, connected with a chronically diseased and ulcerated state of the villous coat of the intestine

℞ Extracti hyoscyami,
Extracti conii,
Extracti papaveris, āā gr. xij
Copaibæ f. ʒiß.
Mucilaginis acaciæ f. ℥j.
Aquæ puræ f. ℥v.

Fiat mistura: cujus sumat æger partem sextam bis terve in die.

Take of extract of henbane, of hemlock, and of poppy, of each twelve grains, copaiba balsam a fluid drachm and a half, mucilage of gum arabic a fluid ounce, water five fluid ounces. Make a mixture, of which a sixth part is to be taken two or three times a day.

Rice, barley, Indian arrow root, oatmeal, sago, and animal broths, are the proper articles of diet.

[*Note.*—We have taken the whole of the three last sections from Dr. Uwins's Compendium of Medicine, merely translating the prescriptions.]

CLASS II.—NERVOUS DISEASES. Neuroses.

386. Both in the general introduction to the present article, and as an immediate preliminary to our disquisition on pyrexial, inflammatory, and vascular disorders, we had occasion to make some prefatory remarks, which were applicable to the whole class of diseased affections comprehended under the term pyrexia. Upon the same principle, and with the same view, we now propose to engage in some considerations on the habits and peculiarities of the sentient part of the organisation, in its reference to disordered susceptibilities and deranged conditions.

On this head there is some diversity of opinion, many conceiving that there is a laxity of signification attached to the term nervous, which is inconsistent with the correctness of just pathological principles; while others, on the contrary, imagine that the speculations and inferences of those pathologists, who are always looking for something visible and tangible as explicatory of disease, do not sufficiently recognise the fact, that both ordinary and morbid sensation are directed often by mere functional peculiarities, which must ever elude a further perception than that of the phenomena which they manifest.

It is, we think, pretty evident that a disposition to extremes has shown itself on both sides of the question; and that the functional pathologists, if so we may term them, have often reasoned and deduced with too little recollection, that sentient impulses are intimately connected with vascular states. Indeed Cullen's class neuroses proceeds too much upon inattention to this principle, while, on the other hand, those individuals who will have demonstrative evidence of every pathological occurrence are frequently led by this very laudable feeling—laudable when retained within certain bounds—to infer that there is nothing in medicine worth

attending to, but what the knife of the dissector can open up, or morbid anatomy confirm.

But it is for us, as encyclopædists, rather to select and collate the sentiments of others, than to obtrude our own opinions; and, in consistency with this duty, we think we cannot be better employed than in presenting to our readers, on the present occasion, some pretty long extracts from authors bearing upon the subject now particularly adverted to.

In every part of the study of nature it is common, says Dr. Beddoes, for ancient distinctions to vanish as a greater number of objects become known; and as every object is more completely investigated, the intervals are gradually filled up; and productions, once held the most dissimilar, are seen to gain a degree of affinity by the successive modifications of the particular features of the extremes in the members that fall in to complete the series.

Proofs of this observation may be found in the attempts which have been made to distribute diseases into classes. In these later ages an infinite number of experiments have raised the brain, the spinal marrow, and the nerves connected with these, into a degree of importance which they did not possess in the estimation of ancient physiologists. It has been found that where the nerve going to a limb is cut, tied, or injured, the empire of the will over the limb is destroyed, and applications to it produce no sensation. What more natural, therefore, than to impute loss of motion and sense to an altered state of that portion of the animal structure of which intentional alterations are followed by the same disability to feel and move? Again, pinch, prick, or otherwise irritate a particular nerve, and the muscle into which that nerve passes shall be thrown into irregular action. When the same irregular actions manifest themselves, without the interposition of any experimenter, it is simple and reasonable to infer that the nerve suffers as when irritated on purpose, and that the cause of the diseased or irregular action lies in the nerve. Here, therefore, we have a foundation for a distinct class of diseases. This class gains extension from other phenomena. That compression of the brain which accidents perpetually produce, and which sometimes the want of the skull or bony cover in the human subject has enabled others to effect at pleasure, have demonstrated that a certain condition of this principal member of the nervous system is an indispensable requisite to perception, locomotion, and to the other exertions characteristic of the healthy waking state. The anatomy of the organs of sense, in different states, has proved how essential their nerves are to the proper performance of their offices. If the optic nerve be entire, other parts of the eye may be removed, and vision remain. The apparatus provided for conducting the sonorous vibrations of the air to the auditory nerve may be totally destroyed, and yet sounds may be conveyed through the teeth. But hearing ceases, or is impaired, by any disorganisation of the nerve of hearing. It is in vain that the other parts continue perfect. To these direct proofs it may be added that a vast quantity of nervous substance is appropriated to each sense, and that it is distributed in a manner which always raises admiration when exhibited. The nicety of the organ also corresponds to the apparent care bestowed in the distribution, as is particularly manifest in comparing the interior of the nostrils in animals which differ in acuteness of smell.

These observations give us two additional kinds of complaints, properly to be denominated nervous. When the hearing is impaired, and the auditory nerve altered in its structure, we have nervous deafness; and nervous dimness of sight, or blindness, under similar circumstances of vision and the optic nerve.

From slight numbness up to utter insensibility, and from premature loss of power to total immobility of a part, there are many gradations; but the whole appear to be steps in the same progress. Hence the first comes to be referred to the same head as the last; and in fact corresponding causes, capable of acting on the nerves, are often discovered in the slighter affections. Mineral poisons make the limbs tremulous first, and afterwards motionless. Fear and anger are every day observed to make persons quake all over. They are occasionally observed to bring on perfect palsy. Indeed common language marks the analogy of these affections. One has often been called the shaking, the other the dead palsy.

So far the deduction appears to proceed satisfactorily. We may follow it yet another step without danger of being puzzled. Supposing a complaint in which a considerable part of the symptoms shall be from the first exactly such as some of those above enumerated, and another part of a different nature, and not by any certain experiment or observation referrible to that particular part of the organisation, yet we may venture to term the whole disorder nervous. We do this with more confidence if the symptoms of each description occur together or alternate. Hysterics may be taken as an example. The same hysterical person shall tremble at one moment, and become blind or deaf, or lose the use of a limb, at another. Then a sneezing or retching of the most excessive violence shall supervene. Not only so, but the paralytic limb shall be restored, in the twinkling of an eye, to its full powers upon the commencement of sneezing or retching, upon a fit of laughing or crying, or the rising of a ball in the throat, or upon the occurrence of any other of the symptoms which show themselves in this infinitely diversified complaint. Now, having referred the universal trembling and partial deadness to a certain change in the state of the nerves, we refer to the same constituent parts of the body, the suffocating ball in the throat, the retching, the sneezing, and the other symptoms, though I may not be able to excite them by any operation upon a dissected nerve. But they appear to be intimately connected and interwoven with the others; and indeed seem to make up one disorder, as different strands are twisted into one rope.

But from this point our track becomes more uncertain. By extending the term nervous, upon the strength of one or two circumstances of resemblance, we are in danger of losing all

meaning, and reducing the most heterogeneous affections to one head. It will therefore, if we would keep clear of embarrassment in language, be necessary to have a word entirely new, or some addition to that which we have hitherto retained, in some cases where nervous symptoms occur. For there occur also symptoms of a different character; and as these predominate they require to be marked. In the beginning of small pox for example, and also of some feverish complaints without eruption, there shall be irregular action of the muscles, or convulsions. Along with the convulsions too there shall be other appearances exactly the same as in diseases strictly called nervous. Yet the small-pox passes not either with nosologists, or with those that follow popular language, for a nervous complaint. The reason is obvious: the nervous symptoms do not generally appear; and in hysteria, if there had only been the retching and the ball in the throat, probably it would never have been considered as a proper nervous disease. The strong pulse, heat, and violent affections of the breathing, in bad cases of small-pox are more common, permanent, and dangerous. They would therefore probably give the disease its denomination, and occasion it to be referred to the inflammatory class, did not the pustules offer so striking an appearance and furnish the matter by which it may be propagated.

There are certainly no diseases of whatever name in which the nerves are not affected; and there are probably no nervous diseases in which the other parts (if they can be considered as destitute of nerves) are not affected. But to call only certain complaints nervous may enable the writer to be more concise without being less perspicuous, which is the proper use of general terms. Nervous disorders then may be considered as those in which the limbs move irregularly or without the direction of the will, in which the organs of perception suffer, and the intellectual functions are disturbed; and this in most instances without any preceding or concomitant symptoms of a different nature, either general or partial.

It is not easy, and perhaps not possible, to invent a term which shall point out any one set of disorders to the exclusion of others. But in common life there would be much less confusion, and somewhat fewer mistakes, if the term nervous were not indiscriminately employed, both where there exist, or have existed, symptoms of a different and peculiar nature, and where they do not. A young person in consumption feels herself low, and is hysterical in various ways; she is therefore persuaded that the cough is nervous; that is, she and her friends persuade themselves there is no danger, or that a treatment very different from that likely to answer is requisite. A gouty veteran becomes tremulous throughout his whole frame. Hence he concludes that he labors under opposite or antagonist maladies; and that if the gout should gain the ascendancy it would deliver him from his other enemy. But in the generality of cases, though it be true that the patient is nervous, it would be more exact to consider him as nervous because he has been gouty. He is only secondarily nervous.

According to a vulgar phrase, when such a one is said, and truly said, to have a complaint of the bile, the physician can frequently ascertain to which of the two opposite states the given case belongs. For in some the liver secretes too much bile, in others too little. Perhaps some such opposition may hereafter be discovered in the variety of nervous complaints. The convulsions to which children are so prone, and the loss of power in old age, would appear to arise from contrary states; the one from excess, the other from defect, of nervous energy? But nothing of this kind can be generally established. Our present acquaintance with the subject does not entitle us to divide the family of nervous ailment into two branches, the one positive, and the other negative. In the same day an hysterical person shall be troubled with painful acuteness of hearing, and with deafness, and be in the intermediate or natural state. The limbs shall be palsied one hour, and the next a strong propensity to motion shall impel the invalid to place all the chairs and tables in a circle, and to skip from one to the other till quite out of breath. Poetical effusions shall follow a fit of stupidity, in a person who is neither dull nor brilliant in her ordinary mood.

In all departments of knowledge, the nomenclature must be as the information. Where one is deficient the other will be vague. In medicine it may be for a long time equally easy to object to a general term, and difficult to replace it by another free from just objections.

All diseases, nay every sort of injury, will, on strict consideration, be found to affect the mind. Some difference in the inward state will be correspondent to the slightest external difference. But in many instances the bodily change is so much more permanent and considerable, that this is overlooked. In a pleurisy, the history of the disease, and of its treatment, is thought to be fully comprehended in an account of the pain, of the pulse, of the breathing, of the number of bleedings, and so forth. In this, and other febrile affections, it is deemed sufficient just to note whether delirium occurs, or at most to mark whether it be a delirium of the low or the frantic kind. Again, the parts concerned in many diseases have been so often examined by dissection, that the physician can read the state of the interior as plainly as if the body were a book, the alteration in organs accessible to sense, and the patient's account of his feelings serving him for letters.

In nervous complaints every thing is different. Changes of the organisation, it is true, have been sometimes detected in nervous complaints, but then the same symptoms equally appear when no such changes exist; so that here morbid anatomy is at present of little or no use in pointing out the correspondence between the obvious and hidden workings of the machine. The intellectual faculties bear a considerable part in these mysterious, and often terrific, scenes. The members, long since reduced under perfect obedience to the will, throw off all control. In ruder ages it was a general persuasion that the furious agitations which sometimes take place were still voluntary, but proceeding from the will of a ma-

lignant spirit who had possession of the patient, and managed his members as the master of a puppet-show does those of his diminutive representatives of man. Among the lower ranks of society, some are still haunted by the same pernicious belief. For these irregularities of thought, feeling, and action, which constitute the essential character, if it be possible to assign the essential character of this class of disorders, we cannot hope to account without some insight into the laws of the human mind. What terrors there are inherent in this subject, different people will probably disagree in attempting to determine. But one thing is clear. It is a subject of enquiry equally shunned by the faculty, and by those who are not of the faculty. Yet it is obvious that the investigation of these laws bears exactly the same relation to the diseases in question, as the comparative anatomy of sound and morbid bodies does to many other diseases.'

We shall follow up this extract from Dr. Beddoes, by a long quotation from Dr. George Gregory, which we consider especially valuable, as corroborating and illustrative of the principle with which we started; namely, that it is of importance, in our investigation of those maladies which are distinctly termed nervous, to appreciate duly, but with proper limits, the information which may be obtained from structural investigation. Indeed, we cannot well conceive of a better introduction to particular disquisitions on nervous affections, than that to which we now beg the best attention of our readers.

'There are not perhaps,' says Dr. Gregory, 'in the whole circle of medical science, any diseases offering so many interesting points of research to the speculative physician, as those which derive their character from disturbance of function in the brain and nervous system, independent of the presence of fever. They may be associated together as the diseases of primary neurosis, and they constitute a series which it cannot but be useful to examine, in the first instance, in a general manner. It will be found that they have a common character, and many points of mutual connexion. To explain these will not only be the means of preventing hereafter much needless repetition, but it will serve to impress upon the student the importance of those pathological relations among diseases, which serve equally to improve and to facilitate practice.

The diseases comprised in this series are apoplexy, palsy, epilepsy, mania, chorea, tetanus, hydrophobia, neuralgia; to which may be added syncope, asphyxia, hysteria, and hypochondriasis. Though deriving their character principally from a morbid condition of the nervous system, they are all more or less connected with disturbed function in other parts. The four last mentioned, however, are so intimately connected with disorder in other organs that, in the present division of the work, I shall merely keep them before me with a view to some points in their general pathology, reserving their separate consideration to future parts of the volume.

Physiology teaches that among the several functions of the brain and nerves, of which some are well, and others only imperfectly ascertained, the principal are sensation, voluntary motion, and the manifestation of the mind. It is natural to expect that, from disturbance in them, the chief characters of the neuroses should be derived; and, accordingly, we find that coma, convulsion, and mental aberration, are the three great classes to which we may refer the symptoms of these diseases.

1. Coma consists in the loss of sensation, thought, and voluntary motion. In this state of disease, however, the organs of involuntary motion preserve their functions; and consequently it is by the continuance of the pulse and of the breathing that we distinguish between coma and the states of syncope and asphyxia. But, though in this manner we are enabled to mark the diagnosis between coma and the disordered conditions of body with which it is liable to be confounded, there are two states, consistent with health, from which it cannot be distinguished by such a criterion; I mean the states of sleep and of intoxication. In all cases of suspected coma it is necessary, for the safety of the patient and the credit of the practitioner, that this point should receive attention. If duly kept in view there is no great probability of any error occurring; for it is inattention to the circumstance, and not any difficulty in deciding upon it when once suggested, from which mistakes have originated. Coma is distinguished from sleep by the impossibility of rousing the patient by shaking, noise, or otherwise. The smell of the breath will, for the most part, be sufficient to characterise the state of intoxication; but in extreme cases there will always be difficulty, for actual coma may possibly have supervened. At all times attention should be paid to the circumstances which preceded the attack; for by this means not only will ambiguity be prevented, but the physician will obtain such an insight into the causes of the disease, and the habits of the patient, as will assist materially in directing his practice.

The abolition of sense and voluntary motion then constitutes perfect coma, and it is the distinguishing feature of apoplexy, the first disease which will be noticed in the present series. It remains to state that the loss of these functions is not always complete. Partial deprivations, both of sensation, thought, and voluntary motion, occur in the chronic diseases of the brain, and they afford many of the most prominent symptoms of such disorders. Of this kind are preternatural drowsiness, or lethargy, paralysis of particular muscles, indistinctness of vision, amaurosis. They are all referrible, however, to the general head of coma.

2. The second set of symptoms occurring in the chronic diseases of the encephalon may be classed together under the head of convulsion or spasm. The state of convulsion is commonly defined to be that wherein the voluntary muscles of the body are excited into action by powers independent of the will. It is not, however, peculiar to those muscles. Not unfrequently those of involuntary motion are similarly affected, the diaphragm for instance, and smaller muscles of inspiration, as in asthma, or the muscular coat of the stomach or intestines, as observed in colic. It would appear indeed as if no mus-

cular fibres were exempt from spasmodic contraction, excepting those of the heart.

Of the voluntary muscles of the body it has been remarked that those which are most immediately under the influence of the will, and most frequently employed, are those principally affected in convulsive disorders, and the same observation will be found applicable to paralytic affections. Of this kind are the muscles of the eyes, eyelids, face, arms, and legs. Spasms of these muscles are observed in chorea, hysteria, and all the lighter forms of nervous affection; while spasms of the muscles of the neck, back, and belly, occur in tetanus, hydrophobia, epilepsy, and indicate a severer kind, or more aggravated degree of disease.

Convulsions have been divided into two kinds—the permanent, and that which alternates with relaxation; in other words, the tonic and clonic. Tetanus affords an instance of the one; hysteria of the other. The distinction is of little consequence unless coupled with the pathological principle that the tonic or tetanic spasm is a disease of infinitely more importance than the common or clonic spasm. The former arises from causes over which we have little or no control, and is, at all times, a state of the utmost danger; while the latter is very frequently little more than the evidence of a peculiarly irritable disposition in the nervous system, and may exist, even to a great extent and for a long time, without exciting any uneasiness for the ultimate safety of the patient. In all reasonings, indeed, concerning a disease accompanied with clonic or common spasm, it is necessary to look to the original constitution and temperament of the individual. There exists in some persons an irritable habit of body, a disposition in the system to be excited on slight occasions, and consequently a more than ordinary tendency to spasm. This manifests itself even when any function of the body becomes, from accidental circumstances, disturbed. Such a habit of body has been denominated by some physiologists the nervous temperament. It is characteristic of the infantile period of life, and of the female sex. The distinction between this irritable habit of body and the morbid state of convulsion, though sufficiently apparent in common cases, is yet, on many occasions, a matter of considerable difficulty. In point of fact they will be found to run into each other by insensible degrees, constituting, as we shall afterwards show, one of the many interesting features in the pathology of epilepsy.

Independent of those convulsive actions of the whole body to which the term fits is popularly applied, there are a variety of partial convulsions referrible to this general head, which occur as evidences of chronic disease within the brain. Of this kind are permanent contraction of the iris, irregular contractions of the muscles of the eye, constituting squinting, and the convulsions of the pterygoid muscles, commonly called grinding of the teeth.

3. The symptoms by which chronic disease of the brain manifests itself may be referred, in the third place, to the head of vesania, or mental aberration. Of this disordered condition of the brain physicians have noticed many varieties. It may be either temporary or permanent; that is to say, it may assume the form of delirium or mania. It may be either general or partial; that is to say, the powers of thought may be completely lost, as in the case of idiotcy; or some one faculty of the mind may be disturbed, while others remain perfect, or only partially impaired. Sometimes, for instance, the imagination labors under a strong and unconquerable delusion, while the memory is perhaps still enjoyed in full perfection. This constitutes the highest grade of mental aberration, and is the characteristic feature of mania. At other times the memory fails, while the powers of perception are still uninjured. This is a frequent consequence of severe injuries of the head, and of paralytic seizures. It is a very common attendant also on that morbid change in the structure of the brain, which frequently occurs in the later periods of advanced life.

Aberrations of mind, lastly, vary in their character and intensity. Sometimes they are attended with fierce excitement, violent aversion, and a disposition to commit acts of violence on themselves or those around them. At other times the delusion of mind is accompanied with a sense, hardly less formidable, of melancholy and settled despondency. To the lighter shades of this disordered condition of the mind physicians have commonly applied the term hypochondriacism. Occasionally we find maniacal aberration coupled with a perfect tranquillity and self-content.

After noticing the general character of the diseases usually called nervous, I proceed to enquire into the opinions commonly entertained regarding their pathology and proximate cause. And here it is to be remarked, in the first place, how manifestly a large proportion of such cases are connected with, and therefore probably dependant upon, certain disordered states of the circulating system. That this principle is not of universal application I shall presently have occasion to show; but in the mean time it will be right to point out what those derangements of the circulating system are, which are so closely interwoven in the pathology of nervous diseases.

1. The first of these is chronic inflammation of the substance of the brain, or of its meninges. That this is the true proximate cause of many cases of chronic disease within the encephalon is abundantly proved by the appearances found on dissection; which are depositions of coagulable lymph upon the surface of the brain, thickening of one or more of the membranes, and suppuration. These unquestionable marks of inflammatory action are, however, but rarely met with, in comparison with two others, frequently adduced as evidences of the same state of disease: I mean increased vascularity within the cranium, and serous effusion between the membranes or within the ventricles. These appearances are very common in different diseases, but in none are they so generally met with as in chronic affections of the nervous system. There are few instances, indeed, of any morbid change of structure in the brain existing without them. Pathologists have differed, however, in their estimate of the importance to be attached to them

especially to that of serous effusion. The general opinion appears to be that, though it cannot be assumed as a proof of the existence of actual inflammation within the brain, it must yet be allowed to denote a degree of morbid excitement of the vessels of the brain, not far removed from inflammatory action.

2. The second of the morbid conditions of the circulating system, connected with nervous disease, is simple congestion of blood in the blood-vessels. This may arise either from an extraordinary flow of blood into the arteries of the brain, or from the difficulty experienced in the return of blood to the heart. The peculiar structure of the large venous trunks of the brain is calculated to lead, under certain circumstances, to stagnation, or, as it is now more commonly called, venous congestion in the head. That such a state of the circulating system in the encephalon does occasionally exist there cannot, I presume, be a doubt; but it may be fairly questioned how far we are able to judge of its existence, with any degree of accuracy, by examination made after death. It is at least sufficiently ascertained, that that fulness in the vessels of the brain, so often found upon dissection, and supposed to denote congestion, depends in a great degree on the position in which the body had lain previous to examination.

3. The third of those states of disease to which our attention must be paid in this enquiry, is hæmorrhagy. The rupture of a blood-vessel within the brain acknowledges many of the laws which affect other hæmorrhagies; but the want of outlet for the effused fluid, the peculiar delicacy of the structure of the brain, the importance of its functions, and, above all, the remarkable effects of pressure upon its substance; give to the hæmorrhagia cerebi an interest far superior to what belongs to any other form of hæmorrhagic disease. The symptoms produced by effusion of blood within the brain, are, with few exceptions, those of apoplexy; and the nature and varieties of cerebral hæmorrhagy will accordingly constitute the most important feature in the pathology of that disease.

4. The fourth morbid condition of the circulating system, observed in certain diseases of the nervous kind, is an imperfect supply of blood. The brain, like every other organ of the body, is dependent for the due exercise of its functions on the circulation. It can neither perform them properly when the supply of blood is too great, nor when it is defective. Syncope is the usual result of a want of due supply of blood to the brain; but convulsions occasionally arise from the same cause, as is well exemplified in the instance of puerperal hæmorrhage. It is not often that we have to apply this principle in the pathology of nervous diseases, but in a general view of the subject, such as we are now taking, it would have been improper to omit it.

5. In like manner it becomes necessary to notice a fifth state of the circulating system which is occasionally present in nervous diseases;—I mean the supply of blood imperfectly oxygenated, and therefore unfit for supporting the functions of the nervous system. This principle, it is true, like the last, is very limited in its application, but it enters into the pathology of apoplexy, and is the foundation of many of our reasonings concerning asphyxia.

I have already stated that there are states of disease of the brain independent, as far as we can judge, of the circulating system.

1. The first of these is simple compression. This may arise either from a coagulum of blood, a soft tumor, a bony excrescence, a depressed portion of the skull, or the presence of some foreign body. The effects of pressure vary extremely, according as it takes place suddenly or gradually. In most instances, as already observed, the symptoms occasioned by pressure on the brain partake of the comatose, or apoplectic character; but instances are upon record, particularly in the case of gradual pressure, where such a state has been followed by symptoms, not of insensibility, but of high nervous excitement, by mania and convulsions.

2. There still remains to be stated one principle of very general application in the pathology of nervous disorders. Hitherto we have had some cognisable cause for the symptoms—the effusion of blood, inflammation, or the pressure of a tumor. But it is to be remembered, that there exists an affection of the brain and nerves equally independent of pressure, and of all disturbance in the circulation within the encephalon. The best illustration of this principle is afforded by the phenomena of the narcotic poisons, where coma and convulsion are produced by means which obviously act on the sentient extremities of the nerves, and which, we may fairly presume, deprive the nervous substance of its mobility, or of its power of receiving or communicating impressions. Such a pathological principle is necessarily obscure, from the very nature of the functions concerned, but it will be found an indispensable one on many occasions, as, for instance, in any attempt at explaining the pathology of tetanus and hydrophobia, or in elucidating those varieties of epilepsy and chorea which depend upon the sympathy of the brain with some distant organ. The principle being once established, there remains no longer any difficulty in understanding why, in a great variety of cases of chronic disease of the brain, no morbid appearances of any kind are found upon dissection. This interesting fact, indeed, has been denied by some, and explained away by others; but it is too frequent and too obvious to be thus got rid of. The student in medicine may here receive an important lesson. He may learn from this, that the causes of death are often as obscure as the sources of life and health; and that morbid anatomy, with all its acknowledged advantages may, if pursued too exclusively, injure rather than forward the conclusion of the pathologist.

The observations now offered on the character and general pathology of nervous diseases will tend to point out the very intimate connexion subsisting among them. The same thing will be further illustrated by a view of their predisposing and exciting causes, by a consideration of their mutual conversion, and, lastly, by a survey of the principles of treatment applicable to the greater number of them. But, before adverting

to these topics, I would wish (without, however, going into any detail on the subject) to notice the attempts which have been made to connect particular symptoms observed during life with certain appearances found after death;—in other words, to establish minute diagnosis among the morbid affections of the several structures contained in the encephalon. Pathologists, more especially those of recent times, have been at pains to distinguish inflammation of the arachnoid, from a similar affection of the other membranes;—extravasation into the ventricles from extravasation with laceration of the substance of the brain;—disease of the anterior from disease of the posterior lobes of the brain;—injury of the brain from injury of the medulla oblongata. It would be presumptuous to say that attempts of this kind are altogether nugatory; but it cannot be denied that hitherto very little success has attended them; that the rules laid down by authors are subject to such numerous exceptions as to interfere greatly with their application in practice; and, lastly, that no reasonable hope exists of deriving from them, even if considerably improved, any portion of practical advantage.

It is of more importance to trace the analogies among the chronic diseases of the encephalon than their minute shades of difference; and we shall be assisted in this, in the first place, by considering the similarity, and even, in many cases, the identity of their predisposing and exciting causes. Mania for instance, and epilepsy, are hereditary. The exciting causes of epilepsy are for the most part those also of apoplexy and palsy. Chorea, hysteria, and many varieties of epilepsy, have a common origin in a disordered state of the stomach and bowels. But in no way is the connexion among these diseases so strikingly displayed as in the circumstance of their mutual conversion, and in their manner of running into each other by insensible degrees. I have already alluded to this in the case of hysteria and epilepsy, but it is equally well marked with regard to palsy and apoplexy, syncope and convulsion, convulsion and mania, mania and apoplexy. One individual of a family has had epilepsy, while others have been deranged. Epileptics commonly die with comatose symptoms. Neuralgic affections are not unfrequently succeeded by amaurosis, or by apoplexy. Instances of this important principle in pathology need not be multiplied, as they must be familiar to all who have enjoyed any share of general practice.

It remains only that I notice the principles of treatment applicable to the greater number of the diseases which are now under consideration, and it will be found that the pathological analogies subsisting among them are strikingly confirmed by the effects of the juvantia and lædentia. The depleting and lowering system adapted to the particular circumstances of each patient, and the peculiarities of each disease, are that upon which the physician places his chief reliance; and it is, with some few exceptions, of powerful efficacy in all of them, whether exhibiting the character of coma, of convulsion, or of mental aberration. This is the great principle kept in view, whether we employ bleeding, purging, leeches, cupping, local cold, blisters, issues, and setons; or content ourselves with remedial means of a less formal though not less useful character, such as a cooling spare diet, regular exercise, or a course of aperient mineral waters. By these means, early, steadily, and judiciously applied, we may often do a great deal towards the relief, or permanent cure, of the chronic diseases of the brain; while without them, and depending upon stimulants, and antispasmodics, our expectations will be but too often baffled.'

The reader who shall have attended to the general bearing of the preceding extracts, will learn the importance of endeavouring to distinguish between structural and mere functional change in all inquisitions as to the nature and peculiarities of diseases which seem, in an especial manner, to have to do with those organs which are destined by nature to be the media of perception, sensation, and even intellect. We are now about to present, we were going to say in contrast, an exceedingly instructive outline of the diseases of nerves, from the pen of an individual to whom morbid anatomy and pathology are under the highest obligations. This quotation we shall follow up by some remarks on the peculiarities of nervous disorders, from a MS. course of lectures which now lies by us; introduce some observations on the principal points of distinction between nervous disorders, as they are termed, and other maladies; and then close the whole by a corollary or two of general combination and application. By this plan we shall lessen the necessity of more lengthened detail that we should otherwise enter into on the individual affections of the class.

'The pathology of the nerves,' says Dr. Abercrombie, 'is entirely in its infancy, but the investigation seems to promise very interesting results. From what we already know, there is every reason to believe, that nerves are liable to diseases analogous to the diseases of the brain and of the spinal cord, which may affect them either in their substance or in their membranes, and are probably the source of several diseases which are at present involved in much obscurity.

In as far as this subject has hitherto been investigated, the following may be considered as the principal idiopathic diseases of nerves which have been observed.

1. A uniform dark red color of the nervous substance, occupying a defined space, perhaps an inch or two in extent. This was observed by Martinet (Revue Medicale, Juin, 1814), in the median nerve, in a case in which there had been violent pain of the fore-arm, followed by palsy. Repeated blisters removed the paralytic affection; but, as soon as the blisters healed, pain returned followed by palsy. In a similar affection of the right sciatic nerve, accompanied by palsy of the limb, he found a diseased portion of nerve enveloped in a quantity of gangrenous cellular tissue. In another case he found a diseased portion of the crural nerve, which was an inch and a half in extent, enlarged to about double its natural size. This portion was of a violet red color, and strewed throughout with small ecchymoses each about the size of a pin's head.

2. Serous or bloody effusion within the sheath

of the nerve, penetrating the substance of the nerve, and separating its fibres from each other. This appearance was found by Martinet in the sciatic nerve of a man who died of pneumonia; he had been affected with violent pain in the posterior part of his thigh, aggravated by the least motion so as to make him cry out.

3. Pus effused in the same manner among the fibrils of the nerve. This was found in the sciatic nerve by Martinet, in a man who died of disease, both in the head and the abdomen, and who had been affected during the latter part of his illness with violent pain in the course of the sciatic nerve. The cellular texture surrounding the diseased portion of the nerve was also penetrated by pus. He found the same appearance in a young man who died of consumption, and who had been affected for two months with lancinating pain, and a painful feeling of numbness extending from the ham to the top of the thigh.

4. Ramollissement of the nervous substance. A man mentioned by Descot (Descot sur les Affections Locales des Nerfs), died in the Hotel Dieu, after he had been for six months blind of one eye. The optic nerve was found reduced through half its extent to a liquid matter of a white color.

5. Ulceration of the substance of the nerve was observed by Mr. Swan in connexion with a fungous ulcer in the leg. There had been such violent pain of the whole leg and thigh, as to render amputation necessary, and, in many parts of the limb, the nerves were found very much enlarged. *Swan on the Local Affections of the Nerves.*

6. Small tumors attached to nerves, and productive of violent symptoms, have been described by various writers. In a remarkable case, by Portal, a woman was cured of epilepsy by the removal of one of these tumors from the thumb. The slightest pressure upon it gave great pain, and frequently brought on an epileptic attack. The removal of such a tumor however from one of the auxiliary nerves by Sir Everard Home, terminated fatally; and the safer mode of treating such affections appears to be to remove the portion of nerve entirely to which the tumor is attached, when the nerve is so situated as to render such an operation advisable. Small tumors or tubercles have also been found on internal nerves. Sedillot found one in the optic nerve, in a case of amaurosis; and Berard has described a black tumor as hard as scirrhus developed in the substance of the diaphragmatic nerve. The man had been asthmatic, but he had also slight emphysema of the lungs.

These tumors are generally very small; but there is another species of tumor which grows to a considerable size. One mentioned by Mr. Pring (Pring on the Nervous System), the size of a pigeon's egg, was cut out from the arm, by dividing the nerve above and below. On cutting into it an expansion of the substance of the nerve seemed to form an imperfect cyst, which contained a medullary and fatty matter, and the filaments of the nerve were continued over it. There had been great numbness and loss of power of the arm, but it gradually improved after the operation.

7. Nerves have been found both very much enlarged and very much diminished in size; and they have been in a few instances found with the nervous substance destroyed, the membrane at the part forming an empty canal. But these points have not yet been sufficiently investigated.

Few opportunities have as yet occurred of ascertaining the condition of the nerve in those interesting cases of local paralysis, which have been so beautifully illustrated by Mr. Charles Bell, and his lamented friend the late Mr. Shaw. It is probable that there is either an inflammatory action in the nerve itself, or its coverings; or that the nerve is affected by disease of some of the parts through which it passes. The only case in which I have had an opportunity of examining the parts, since I was acquainted with the discoveries of Mr. Bell, was lately, in a woman about forty years of age, who died of organic disease of the stomach. About a fortnight before her death, she was seized with twisting of the mouth and paralysis of the orbicularis of the left eye. She had afterwards considerable indistinctness of speech, and, before her death, there was inflammation of the left eye, with an evident tendency to sloughing of the cornea. A small hard tumor was felt under the ear, deeply seated betwixt the angle of the jaw and the mastoid process. On dissection no disease could be discovered in the brain. The tumor under the ear was found to be the size of a small bean, very firm, of an ash color; and, when cut across, it discharged thin puriform sanious fluid from minute cells in its substance; it lay directly above the facial branch of the portio dura; and there was considerable appearance of inflammation in the cellular structure surrounding the nerve; but I could not discover any deviation from the healthy structure in the nerve itself. I thought it was diminished in size at the place where the tumor lay over it, but in this I might be mistaken. In a case by Descot, connected with extensive suppuration and caries of the auditory portion of the temporal bone, a part of the portio dura was entirely destroyed; and in a case by Billard, connected with an unhealthy abscess of the parotid gland, the course of several of the nervous branches was interrupted by destruction of part of their substance. An epileptic patient, mentioned by Serres, had inflammation followed by opacity of the right eye, loss of feeling of the conjunctiva, and insensibility of the right nostril, and right side of the tongue. He died of an affection of the brain; and, on inspection, the fifth pair of nerves, at its origin, was found yellow, softened, and reduced to a state almost gelatinous.

To this source, diseases of the nerves, also, are referred certain severe and obscure affections of the nervous kind, some of which have supervened upon slight injuries, and others come on without any obvious cause. A young lady, mentioned by M. Verpinet, received a slight wound with the point of a sword on the inferior and outer part of the fore-arm It very soon healed, but most violent pain continued in the fore-arm, wrist, and hand, accompanied by convulsive motions of the arm, and loss of the voluntary power of the wrist and fingers. The affection resisted every mode of treatment for two years, and then got speedily well after the

application of the actual cautery to the cicatrix of the original wound. In a lady, mentioned by Mr. Swan (Jour. de Med. vol. x), a slight wound on the thumb was followed by numbness, pain, convulsive motions of the arm, and spasms, which occasionally affected the opposite arm, and sometimes the whole body. In this case the affection seemed gradually to wear itself out, though she was not entirely free from uneasiness at the end of seven years. A very violent case of the same kind, described by Mr. Wardrop, (Med. Chir. Trans. vol. viii.), was cured after twelve months by amputation of the finger. In a similar case by Larry, which followed a wound, a portion of the nerve was removed, without complete success, though the disease was very much alleviated. In a singular case by Sir Everard Home (Phil. Trans. 1801), a gentleman received a violent sprain of his thumb, by the weight of his body being thrown upon it, in saving himself when nearly thrown off, by a sudden motion of his horse. He was afterwards liable to paroxysms, in which his thumb was first bent in towards the palm of his hand; a spasm then took place in the muscles of the arm, after which he became insensible, and continued so for about a quarter of an hour. The attacks returned frequently in the arm, but it was found that the pressure of a tourniquet prevented the insensibility. A nerve in this case was divided without success. The tourniquet lost its effect in arresting the spasms, and he died suddenly after three months, but there was no examination of the body.

In the Medical and Physical Journal, Mr. Jeffries has described a remarkable case of a violent neuralgia of the face, which was cured by the extraction of a small fragment of china, which had been lodging there for fourteen years; and M. Descot mentions a case in which a very severe affection of ten years standing was removed by the extraction of a carious tooth. A young lady, mentioned by Mr. Pearson, was seized, without any obvious cause, with pain in the thumb, accompanied by a morbid sensibility of the part; the affection gradually spread over the arm, and was accompanied by loss of nearly the whole muscular power of the extremity, with morbid sensibility of the integuments, and a strong contraction of the fingers, so that the points of the nails were forcibly pressed against the palm of the hand. The fingers were not under the control of the will, and every attempt made to extend them was accompanied by insupportable pain. The joint of the elbow also was contracted, and voluntary motion was nearly lost over the whole extremity. It was also very much diminished in size, while the morbid sensibility of it was inexpressibly distressing. After some time the other arm was slightly affected in the same manner, and she had likewise pain and great debility of both the lower extremities. After this affection had continued about a year, it got well under the use of a liniment composed of olive-oil, turpentine, and sulphuric acid. This produced most severe erysipelatous inflammation, which, beginning upon the affected arm, extended afterwards over the whole body. (Med. Chirurg. Trans. vol. viii.)

Little has hitherto been done on this curious and interesting subject, but it certainly promises most important results, when it shall be more extensively cultivated. For we have every reason to believe that both the nerves themselves, and the investing membrane, are liable to affections which may be the source of many obscure diseases. It is now upwards of fifteen years since I first saw a girl, aged at that time about eighteen months, and previously enjoying excellent health. She had been left for some time sitting upon damp grass, and was immediately seized with fever, accompanied by such a degree of oppression as led to an apprehension of an affection of the brain. These symptoms, however, passed off in a few days, and, upon her recovery from them, it was found that she was entirely paralytic in the right lower extremity. She has from that time enjoyed uninterrupted health, and is now a big and strong young woman, but the right lower extremity has continued entirely paralytic. It is also a great deal smaller than the opposite extremity, and several inches shorter. All the joints are remarkably relaxed, and the muscles flaccid; but there is no other appearance of disease in any part of it, or in the spine. Very lately I was consulted about a young man, aged fourteen, who had nearly lost the muscular power of the upper part of both his arms, accompanied by a most remarkable diminution of substance of the principal muscles. The deltoid and biceps are reduced to the appearance of mere membranes, and the same affection extends in rather a less degree to the muscles upon the scapula; the muscles upon the fore-arm, however, are full and vigorous. No disease can be discovered about the spine, and in other respects he is in perfect health. The affection has come on gradually, and cannot be traced to any cause.

It is impossible, I think, to explain such cases as these, except upon the principle of local affections of nerves, which are at present involved in much obscurity. There are various other affections which can only be referred to the same subject, and which present some very singular phenomena, though the facts relating to them have not yet been brought together in any connected form. Some time ago I was consulted about a singular disease of this nature, which occurs in paroxysms, and affects in the same manner two individuals of one family, a young lady of twenty-five, and a young man of twenty-two. The lady describes the attack in the following manner. She is first affected with blindness of the right eye, which comes on gradually as if a cloud passed slowly over the eye; about a quarter of an hour after this she feels a numbness of the little finger of the right hand, beginning at the point of it, and extending very gradually over the whole hand and arm, producing a complete loss of sensibility of the parts, but without any loss of the power of motion. The feeling of numbness then extends to the right side of the head, and from this it seems to spread downwards towards the stomach. When it reaches the side of the head she becomes oppressed and partially confused, answers questions slowly and confusedly, and her speech is con-

siderably affected; when it reaches the stomach she sometimes vomits. The feeling of numbness then begins to subside, and, as it goes off, she is seized with violent headach, which continues for several hours, and leaves her for a day or two feeble and languid. The progress of the feeling of numbness, from the little finger to the stomach, sometimes occupies several hours, and the common duration of the whole paroxysm is about twenty-four hours. The frequency of its occurrence varies from a few days to several months; she has been liable to it for several years, but in, the intervals betwixt the attacks, she enjoys perfect health. Her brother, who is twenty-two years of age, is affected almost exactly in the same manner, and he has been liable to the paroxysms for many years. He is a banker's clerk, and in the intervals between the attacks enjoys perfect health. When he feels the commencement of the attack, he hastily brings to a conclusion any business in which he happens to be engaged,—gives distinct instructions to another of the clerks in regard to the state in which he leaves the affairs of his department; then walks home, goes to bed, and soon after becomes insensible. Next day he is in his usual health, except a considerable degree of languor.

These singular cases are under the care of Dr. Gibson of Montrose, and in a letter, received from him as these sheets were going to press, he informs me that they are considerably improved. He thinks they have both derived benefit from a course of purgatives, followed by a course of sulphate of quinine, combined with small quantities of rhubarb. Dr. Gibson adds, that another of the family, a stout young man of twenty, has lately had several attacks of a similar affection, though in a slighter degree.

The affections of internal nerves present a subject of still greater difficulty, and the observations that have been made in regard to them are at present far from being satisfactory. Lobstein (De Nervi Sympathetici Fabrica, usu, et Morbis) thinks he has ascertained the existence of inflammation of the great sympathetic nerve; and to this source he refers many obscure diseases, such as violent hysterical affections, sympathetic affections of the heart, spasmodic cough, colica pictonum, angina pectoris, and many obscure affections of the stomach and bowels. In the same manner he explains the fatal effects which are produced by blows upon the stomach, and the severe symptoms, both in the head and in the general system, which often arise from worms, and from other disorders of the bowels. In a lady who died of urgent vomiting, with burning pain in the spine and on the right hypochondrium, he found the semilunar ganglion in a state of intense inflammation, and the lower part of it livid. In a boy who died with great oppression of the chest, and distension of the epigastrium, supervening upon the retrogression of a miliary eruption, he found deep inflammation of a part of the trunk of the left intercostal nerve, and of the ninth and tenth thoracic ganglia.

These speculations must be received with much caution, especially as nothing is more precarious than morbid appearances, consisting of mere change of color of parts, without any of the actual results or terminations of inflammation. We must forbear to speculate where we have not facts before us, but it appears extremely probable that there are diseases of internal nerves which may be the source of important morbid phenomena. Descot exposed the par vagum upon the neck of a dog, and bruised it on both sides slightly with a pair of pincers; the wound healed favorably, but the animal was affected with general tremors, difficult and laborious breathing, vomiting, great debility and wasting. The vomiting subsided, and the other symptoms were diminished, but he had not recovered a natural state of his breathing, when he was killed at the end of three weeks. The internal organs were all healthy. The nerve on the left side, where the injury had been inflicted, appeared slightly increased in size, and was of a yellowish color; and that on the right side appeared more decidedly enlarged, highly injected, and adhering to the neighbouring parts.'

The following is the extract from the MS. lecture, to which we have above referred:—

It has been said that the rationale of nervous agency is in some sort a matter more out of the reach of our perceptive powers than that of the blood's circulation; or of the assimilation of dead to living, or organic particles. In disturbed or deranged functions, implicating this portion of the frame, there will of course be found a corresponding difficulty attendant upon their divination. We see an inflamed part of it is on the surface of the body, and we know that it consists of a disordered action of the circulatory powers—at least we know that such disordered action is present. In like manner, we can perceive the tumefaction of a diseased lymphatic gland; but a limb or an organ will oftentimes be deprived of its loco-motive, or perceptive susceptibility, without the eye of the observer, or even the knife of the dissector, being able to detect any difference in the organisation from that of health. When, then, we say a malady is nervous, we imply that the faculty of perception is especially implicated, and, knowing that the nerves are the media of that faculty, we infer that these are its seat and source.

But we are naturally discontented with mere inference, and are anxious for demonstration: and this anxiety has seemed to me occasionally to have introduced into pathology, especially into the pathology of the present day, a somewhat erroneous notion in respect to the origin of some disordered states. Many of us seem hardly disposed to allow that any purely nervous derangement can have place, and are ready to accuse either the vascular organs, or the first passages, with being the occasion of the present mischief, when neither the one nor the other has had to do with producing the state in question; for, however difficult the explanation of the fact, fact it seems to be, that independently of the blood-vessels—that independently of the assimilating organs—that independently of the digestive processes, the nerves may be brought into a condition of morbid being, occasioning an irregularity in feeling and function, which may be named, in strict propriety, a nervous ailment.

True it is that, in consequence of the intimate

connexion in structure and office which one part of the body has with another, an affection of the sentient organisation is very often soon followed by vascular and other disturbance; but, even in that case, the blood-vessels are not the only part to be regarded, either in our estimate of the nature of the disorder, or in the institution of our curative means; it is ever indeed of prime importance to ascertain, as nearly as possible, what share a disordered state of the nerves has had in the production of a disordered state of the circulation. But I am now to speak generally of more strictly nervous derangements.

We may first notice a very curious fact—viz. the loss or suspension of the ordinary perceptive faculty, while every voluntary muscle remains obedient to the mandates of the will. Dr. Haslam has given us an account of a patient, a female, having dreadfully mangled her jaw, by a piece of glass, in an ineffectual attempt to commit suicide, and being without any sensation of pain during the whole process. Dr. Heberden, too, speaks of an individual, who, under the influence of some temporary impression, cut away the whole of his testicle and penis, and who afterwards stated that he had not the smallest recollection of feeling any pain from the process; and how often do we see instances of religious or political enthusiasm absorbing the faculty to such a degree, that inflictions of the most violent kind are borne almost without perception.

'Perhaps,' says an eloquent writer, 'no combination of affections could be feigned, which cannot be matched in faithful medical reports, and the reality exceeds whatever the most fertile fancy could invent in readiness to be affected, in violence, in the whimsical manner in which the symptoms are grouped, and in the rapid changes from one state to another. In this last respect, what is fabled in romances and masks, concerning the power of the enchanter's rods, to induce in a moment the stiffness of a statue, or to restore the spell-bound person to motion, is much exceeded in nature; and it is possible that fiction took the hint from this species of reality, since it always must borrow from one species of reality or another. That the dropping of a hair-pin on the floor should make a person start from her seat, and fix her in a preternatural posture, by occasioning preternatural fixed contractions and relaxations equally preternatural, till she sink into insensibility, from which she awakes into vehement delirium, is hardly credible to those who are conversant only with the healthy, and the sorts of sickness to which the robust are subject.

'On comparing an individual, liable to these sad varieties of being, to the engineer who stands unmoved amid the thunder of a battery, to the seaman who maintains his footing upon the deck or ropes of his vessel, reeling under the shock of the elements, or to the Indian who exhibits the signs, and probably feels the throb of intense delight while the flames are preying upon his flesh, how astonishing do we find the range of human susceptibility to the effects of the powers by which we are surrounded!'

Indeed, almost numberless instances might be adduced, both from modern and ancient authors, bearing upon this point; but it is the fact alone about which we are interested. Now this peculiarity is in a greater or minor degree characteristic of a great many nervous complaints, variously delineated in nosological systems; and there are no persons who at all times have exactly the same measure of local insensibility; the shades varying in degree ad infinitum, without the anatomist being able to state any variety in structure or organisation, upon which the variation had depended, and without there being apparently a particle more or less of blood in the vessels of the part than under circumstances of health.

On the other hand we find in some cases an acuteness of feeling in one part or organ, which is totally inexplicable by any à priori reasoning, or anatomical peculiarities. Haslam (to give one example) speaks of a man in Bedlam who was so sane and rational in all his deportment that he was on the point of being dismissed; but he was detained in consequence of having communicated to Dr. Haslam a secret of importance. 'Never,' says the man, 'venture to walk in a certain apartment, for there is a subterraneous fire under that room which communicates such a heat to the floor that I never walk there without having my feet burnt.' Now in this case there must have been an actual perception of pain in the feet from some unknown condition of the brain and nerves; a condition upon which no light is thrown by any reference to the state, at the time, of the vascular actions; and if we talk of mental peculiarities we are equally gratuitous in our explanatory phraseology—since we know nothing of the manifestations of mind but through the medium of the physical frame.

Another very remarkable affection, to which the sentient organs are obnoxious, consists in the existence of perception to a very acute degree without the power of expressing to by-standers that such perception is present. This constitutes that state which is vulgarly named a trance, and may be looked upon as merely a more than common measure of that affection to which we are all liable, as when we are susceptible of a greater than ordinary difficulty in conveying to others or embodying in language the thoughts and feelings which pass in our own minds, nay our own case. Again, one whole order of perceptions shall be abolished, or for a time suspended, while other functions shall be exercised with even more than accustomed facility; an extreme extent of which state is exemplified in the phenomena of somnambulism or sleep-walking, while in all these varieties of being the arterial pulsations shall not undergo any appreciable change, proving to a demonstration that it is the nervous and not the vascular organisation that has been the especial residence of those peculiarities, whence the alterations have originated.

These facts, with volumes of others that might be adduced, of a similar kind, ought, in my mind, to teach us two lessons. They ought to instruct us in the inefficiency of that pathology and practice, which should be regulated upon no other principles than that of vascular irritation or con-

gestion in blood-vessels; and they ought moreover to keep us constantly alive to the remarkable subordination of the physical to the mental part of the frame. A fact and principle in medical experience and theory which it seems to me we are occasionally at least too much inclined insufficiently to appreciate. If it were nothing but the importance which the knowledge and attention now adverted to would teach of manner in the practice of medicine, that itself in its application would be found of no mean moment. I should, I hope, be one of the last to recommend hypocritical charlatanism, and assumption of superior powers; but when we find that the assumption itself has an effective influence, it ceases to be a dishonorable or immoral act. If then we wish for success, in the administration of medicine, let us in prescribing it be careful to join a mildness of manner, with a confident deportment. This is not as I have said to assume a virtue which we have not, but lawfully to act upon the susceptibility of our patients towards assisting by every means in our power their restoration to health.

While I am upon this head it may not be improper to state a single example of the influence of imagination upon the actual physical condition, which is furnished us by Dr. Haygarth in the pamphlet which he published on the subject of the Pretensions of the Metallic Tractors; in order to show that we might even admit all that these pieces of metal laid claim to in respect of actual effect, and yet notwithstanding maintain the fallacy of their claims to any actual virtue in and of themselves.

It is necessary to premise that, in the trials which Dr. Haygarth records, pieces of stick and iron were employed while the patients invariably supposed themselves to be under the influence of the genuine metallic tractors. The case which I have selected was transmitted to Dr. Haygarth by Mr. Smith of the Bristol infirmary, a man of unquestionable credit and veracity. 'Edmund Williams,' says Mr. S., 'applied to me with an obstinate affection of the urinary organs (stillicidium urinæ). The man was a poor feeble subject, and appeared to be impressed with the idea that he should never recover, that nothing would be of service to him, but he was willing to try every thing. In one minute after the points of the wooden tractors had been drawn in various directions about the pelvis, he said I begin to feel something jumping in my inside, and in three minutes and a half the determination of blood to the capillary vessels of the skin was evident, giving him the sensation of warmth to which he had been long a stranger. On the 27th he reported that his hips had been unusually comfortable and warm: this induced me to persevere, especially as the patient himself had become less sceptical as to the powers of the tractors. The gentleman who assisted me having borrowed the pieces of stick I was obliged to make use of two-penny nails, which had before been used on a similar occasion: these were disguised with red sealing wax, and on this account had the dignified appellation of rouge et noir. In fact it was often necessary to play the part of a necromancer, to describe circles, squares, triangles, and half the figures of geometry upon the part affected, with the small ends of our feigned tractors. During all this time we conversed in the patient's hearing upon the wonderful discoveries of Franklin and Galvani, laying much stress upon the power of metallic points attracting even lightning, and conveying it to the earth harmless. To a more curious farce I never was witness; we were almost afraid to look each other in the face, lest an involuntary laugh should remove the mask from our countenance and dispel the charm. But to return to my patient. In one minute he felt 'a smarting in his loins and warmth of the skin;' in two 'heat increased;' in four the operation ceased when he said the 'skin was very warm:' a bystander asked him if he thought himself mended? he replied, 'He would soon answer his question,' and upon sitting down suddenly exclaimed 'yes, I am better.' It was demanded 'how he knew it?' 'When I used to sit down,' he replied, there was always a spirt of water thrown from me, but now I can prevent it.' The experiment was two or three times repeated, and with the same result: in fact the patient absolutely regained the power of retention in a great measure afterwards.'

On this case the reporter of it makes the following reflections.

It may be asked what physical alteration could so suddenly have taken place in the muscular fibres of the sphincter of the bladder, that, from a state of pallid relaxation, they should again be endowed with the power of performing their office. Permit me in my turn to ask the enquirer what is the primary cause of the purple blush which instantly overspreads the cheek of the guilty when accused? Would it be answered because the vessels are distended suddenly with blood; that will be readily granted as the remote cause, but it is the power which directed that operation which I wish to be demonstrated. We shall be equally involved in the same dilemma, but, the facts being admitted, our inability to account for them signifies nothing.

Such cases as this lead to more important inferences when properly appreciated than that for which the experiments were principally instituted, namely, the detection and derision of a gross system of quackery; they are mainly to be valued in the use that may be made of them in regular aud legitimate and conscientious endeavours to restore health; they serve to evidence that very important principle in the theory of living actions—that mental stimuli are by no means limited in their operation to the sentient organisation and faculties; but that they display an agency decided and demonstrative, upon even the minutest fibre entering into the composition of an animal body.

'It is worthy of observation,' says Dr. Cogan, who has written on the Passions, 'that, in every powerful exertion of the imagination, some change takes place in the body corresponding with its nature. In a keen appetite, upon the thoughts of some favorite viand, the salivary glands are stimulated to a secretion of saliva as preparatory to deglutition. We feel ourselves firm, collected, elevated, upon the timely representation of the firm heroic conduct of others. The blood thrills in our veins, and the skin corrugates

at the description of any thing peculiarly horrible; and, under the strong impression of fictitious danger, the attitude of our bodies attempts to evade it. Full confidence in the mystic power of another places the whole system in a situation most favorable to the effects, which the object of his confidence undertakes to produce. This will explain much of what is real in the pretensions of magnetisers, and the exaggerating disposition of both operator and patient will serve to explain the rest.

I have thus, continues the lecturer, guided by the order of my subject, called your attention to the influence of mental impression in aiding and regulating the agency of physical powers, not with a view to make you contemn, but, on the contrary, for the purpose of inducing you duly to appreciate and properly to apply the virtues of medicine in the cure of diseases.

This fact of mental agency upon physical conditions and powers, while it gives us a clue, as we have seen, to the success of unprincipled pretenders to nostrums, directs us as far as we are permitted by a sense of rectitude of conduct and manliness of character to make the best use of that faith which the subjects of our care are ready to repose in our skill; and confers a dignity and importance on the medical profession beyond that which could be claimed from a mere routine acquaintance with drugs and antidotes.'

It will be hardly necessary to say in addition to the above extracts, and the intimations we have already dispersed among them, for what purpose we have thus collated and compared the sentiments and statements of different authors in respect to the pathology of the nervous organisation. We wish to impress upon the mind of the medical student, while it is his duty to seek every opportunity of investigating morbid structure in connexion with morbid action, that such is the nature of the organised body, and such its connexion with external circumstances, that a great deal goes on in the interior of the frame, of which no possible explanation will ever be given if we wait until the knife of the morbid anatomist unfolds the secret. We wish it further to be understood, that the alteration of structure, which post mortem examination unfolds, is often rather the effect than the cause of the malady which has terminated life; or that, even if such alteration or structural disorder has been the means of severing the thread by which existence is sustained, previously disordered workings of a general kind, and not merely the topical malady, have been in point of fact the main and radical source of the incidental derangement of structure. But on the other hand let us always be alive to the probability of mere topical lesion being equal to the production of an immensity of constitutional derangement; and let us feel grateful to such pathological patience and discernment as that evinced by Dr. Abercrombie, in his endeavours to place medicine as much as possible upon the footing of a demonstrative science.

We now proceed to consider the several genera included by Cullen in his class neuroses.

387. Order 1. Comatose Affections. Comata.—On this order we need add nothing to the remarks which have been submitted on the pathology of nervous affection, of its occasional, and indeed most frequent, connexion with the brain, and on the question of pressure upon or other disordered condition of the encephalon inducing the comatose state. See the remarks just made on the class, and those on the nosology in the third division of the present article.

388. *Apoplexy.*

Symptoms.—The patient in the most common form of apoplexy falls down as with a sudden stroke, which the name imports; he is deprived of sense and motion, unconscious of every thing that passes around him, and as if in a deep sleep, for the most part making a stertorous noise. While sense and motion are thus suspended, the heart and arteries, as noticed in the definition, continue to carry on the circulation. It is not, however, invariably that this apoplectic seizure is thus so sudden or so complete. Sometimes it is preceded by violent pains in the head, sickness of stomach, dimness of sight, paleness of face, vertigo and loss of recollection; this state lasting for some time, at length complete coma supervenes, and the patient becomes equally unconscious as when the attack is more sudden. Sometimes a palsy of one side precedes the coma, and the apoplexy seems to proceed from the palsy, as the palsy in other cases follows the apoplexy.

In which ever way the apoplectic fit commences, there are certain appearances presented during its continuance which merit attention. The pulse at first is commonly small and irregular; but, as the system recovers from the shock, the pulse becomes full and strong, and is generally slower than natural. Respiration is much embarrassed, being always slow and occasionally irregular. In all the severer degrees of the disease, this laborious breathing is accompanied by stupor; and a frequent appearance is that of foam or frothy saliva excreted from the mouth and blown away from the lips with considerable force.

The skin is commonly warm and bathed in a copious perspiration. In the worst cases of the disease a cold clammy sweat has been observed. The face is generally pale, the cornea dull and glassy, and the pupils permanently dilated. The teeth are closely clenched, and the power of swallowing, though seldom wholly lost, is for the most part so much impeded as to oppose the most serious obstacles to the administration of remedies. The bowels are torpid, as is usual in all cases of cerebral oppression, and they resist the action even of powerful cathartics. If blood is drawn from the arm the coagulum is commonly firm, and Sir Gilbert Blane has noticed that it is in most instances covered with the inflammatory crust.

The duration of the apoplectic fit varies from two or three hours to as many days. Thirty hours Dr. Gregory (from whom we principally extract this very correct history) states to be the average duration of those which have fallen under his own observation. Instances indeed are on record of sudden death from apoplexy; but in many of these cases there is reason to suspect that the immediate cause of death was

rather to be found in some affection of the heart, or large blood-vessels in its neighbourhood, than in injury to the brain.

It should be observed that the full paroxysm is occasionally ushered in by premonitory symptoms of more gradual occurrence and permanent character than those above mentioned. There will be vertiginous sensation, loss of memory, the perception of black spots floating before the eyes, faltering in speech, more than usual drowsiness, and indisposition to take an interest in the common affairs of life, and in fine all the indications of cerebral disturbance for some length of time. The most usual times of apoplexy's occurrence is between the age of forty and sixty; the most common times of the year are in the spring or fall, when atmospheric temperature is subject to sudden variations.

Causes.—Certain conformations of the body are considered as predisposing to apoplexy. The apoplectic make, consisting of a short neck, large head, and florid complexion, is proverbial; though some have questioned whether individuals thus constructed and circumstanced are more obnoxious to the complaint than others. Habits of life may increase the tendency to apoplexy without always proving the actual excitants of the malady. These are, full living, the indulgence of wine, sleeping after dinner, and lying in bed in the morning longer than is proper; mental anxiety, intense thought, carelessness as to the alvine evacuations, neglect of exercise, and indulgence in venery.

The principal exciting causes of apoplexy are, the immoderate use of wine and spirits; exposure to cold, so as to check the perspiration; violent exertion of body or mind; very long or loud speaking, especially if much mental exercise accompany it; gout, rheumatism, and cutaneous disorders, translated from the extremities or surface; severe fits of coughing; stooping the body; exposure to hot suns, producing apoplexy in the way of coup de soleil; warm bathing injudiciously used; and the inhalation of poisonous vapors. In respect, however, to the first mentioned sources, there is reason to doubt whether, when they affect the frame violently, and even to the production of death, the effect is not for the most part of a different character from that of the apoplectic seizure.

In respect to the proximate cause of apoplexy, as pathologists sometimes express themselves, or that state of brain which is necessary to the actual induction of the fit, we shall find in this, as in most other affections, that it is various. Intimations on this head have already been thrown out; and we may here repeat, that, although some contend for the necessity of absolute hæmorrhage upon the brain, or at the least for effusion, to produce genuine apoplexy, it should appear that there are several conditions of the cerebral system which at different times constitute the immediate cause, or the actual circumstance of the disorder. Slow inflammation of the membranes; mere temporary fulness of vessel; gradual loss of power in the nervous system, and in the brain, especially as the main portion of the nervous mass; ossification, or other obstructions to some of the vessels, causing too little blood on one part of the brain and too much on another; these, and probably other circumstances and conditions, may occasionally prove quite equal to the production of the apoplectic state. The old division of apoplexy was into sanguineous and serous; the one being constituted of actual blood poured out from vessels, the other of the extravasation of serum. Another division has been suggested of cerebral and meningeal the one consisting in hæmorrhagia cerebri, and always attended or followed by palsy; the other existing in the membranes, not in the substance of the encephalon, and not being accompanied by paralysis. It may be observed of all these distinctions that there does seem some foundation for them, but that none of them are tenable in the abstract way which systematists have assumed them to be. Of one thing we may generally feel pretty certain, that if with a decided attack of apoplexy there is a decided loss in the power of one limb, or one side, a rupture of blood-vessels, or at least a pouring out of either actual blood or serum upon the brain, has been the occasion of the symptoms. And here we may remark, in connexion with the proximate cause of apoplexy, that the circumstances are generally illustrative of the decussation of the nervous system: at what particular part this crossing or interchange of nervous fibres takes place does not seem to be quite a settled point among pathologists; but that it does obtain is rendered evident even by the phenomena of an apoplectic seizure, or a blow upon the head; the resulting paralysis being on the side opposite to the part of the brain in which the lesion is made. It is, however, a curious fact, that this, though a general, is not an invariable occurrence: now and then the injury, or hæmorrhage, or lesion, of whatever kind, and the consequent palsy, are on the same side; which increases the difficulty and perplexity that still accompany all investigations on the subject of encephalic lesion for the purpose of throwing light on the function of the brain as connected with its structure. On a subject which is so exceedingly obscure we ought to receive with great commendation the exertions of industry directed to this point of pathology; which, if they do no other good, are at least calculated to prevent that hasty and erroneous generalisation, with respect to structural function, to which some physiologists have on the other hand proved themselves too prone.

Distinctions.—Was the complaint of which the patient died apoplexy, or epilepsy, or intoxication, or other disorder of the brain? is often a question proposed by curiosity, and sometimes in the course of judicial inquisition. These distinctions are sometimes not very easily traced; indeed one state of the brain often falls into another, and systematic nomenclature, we wish again and again to urge, often assumes a precision which does not obtain in fact. From epilepsy, however, we may generally say, apoplexy is distinguishable by the absence in the latter complaint of that foaming at the mouth and convulsions which characterise the epileptic paroxysm; a secretion of saliva does indeed, as we have above remarked, occasionally attend upon the apoplectic fit, but it is puffed out with the

respiration in a different way from that which is seen in epilepsy; and the more that there is a tendency to convulsive distortion of countenance and limb, and the more that saliva is excreted from the salivary glands, in that proportion does the disorder recede from true apoplexy and ally itself with epilepsy. From hysteria apoplexy differs by the absence in the latter of that sense of constriction about the throat, called globus hystericus; which, in some forms or grades of the hysteric disorder, is so exceedingly urgent. From intoxication the distinction is to be taken by the absence, in apoplexy, of any vinous or spirituous smell in the breath; by the respiration being more stertorous, and by the patient being for the most part more insensible to temporary rousing by shaking or loud talking.

Prognosis.—A person having once been apoplectic is scarcely ever the same person again that he had been prior to the attack, so that in one sense we may say the prognosis is almost without exception unfavorable. Apoplexy indeed, occuring in early life, in a full, plethoric, vigorous individual, and induced by some evident excitation, may be taken as an exception to the rule now laid down; but the exceptions are rare, and apoplexy of old age always leaves either an enfeebled understanding, an impaired muscular energy, or at the least a more than original tendency to its occurrence again.

The favorable signs, in respect to the prospect of recovering from the present attack, are the senses being but little impaired, the breathing becoming more free and easy, the pulse more natural or less jirky and obstructed, warm sweats breaking out, the occurrence of spontaneous hæmorrhage, and hæmorrhage taking place either from the hæmorrhoidal vessels or from the nose.

The unfavorable signs are the protraction of the insensibility beyond the third day, the pulse becoming still more oppressed and hard, fever supervening, though in some cases the re-action of recovery is accompanied by fever, so that Hippocrates puts this down as one of the favorable signs; when, however, fever occurs while the patient remains heavy and oppressed, we should say, the degree of fever is almost the degree of danger. Cold, clammy, and partial sweats are also dangerous prognostics, a dribbling of saliva from the mouth, red heavy appearance about the eyes, and cold extremities, all forebode ill. A dilated pupil is universally allowed to be a bad sign; but we are told, by Dr. Cooke and others, that some of the worst cases of apoplexy are accompanied by a remarkably contracted pupil.

Treatment.—During the paroxysm, the patient, if possible, should be laid in a spacious and airy apartment, and all causes removed that impede respiration; the head, and this direction is not perhaps always sufficiently attended to, should be placed high on the pillow; pillows too, or other supports, should be put under the shoulders, so that there should be as little bend as possible in the neck. All ligatures or tight dress should be as speedily as possible loosened, and some have directed the feet and legs to be put into hot water. Blood is to be withdrawn in greater or less quantity, according to the degree of arterial action that may be indicated by the state of the pulse; if this be not high, and there should seem a collapse of the system, and a state somewhat similar to what surgeons call concussion of the brain, it will be better to defer the bleedings till signs of reaction present themselves; but bleeding should never be deferred in the full sanguineous attack, and where there is every mark of plethora and high action. One or two pounds may be taken at once, and repeated in five or six hours afterwards should the stertor and high action continue. The following day the bleeding may be again repeated if we appear to be gaining a little ground without having gone far; but we must now be fearful of carrying the evacuation too far, lest we induce a collapse, which, under the present circumstances of the brain, would not be likely to be recovered from. It is not here as it is in some forms of active and sthenic inflammation, where faintness is a state of things rather desirable than otherwise; or, at any rate, if we stop the internal flow of blood by the production of faintness, we at the same time may do still more injury to the brain's energy than we have done good. Indeed, than bleeding in apoplexy, nothing can be conceived a nicer point, and more requiring a tact and judgment which can scarcely ever be assisted by abstract precept, but must be guided by circumstance. We have seen patients bled out of insensibility, and again bled into it, by a too free repetition of what in the first or perhaps second instance was good practice. When a large quantity of blood is demanded, it is for the most part best to take it from the arm, especially if there be any want of dexterity in the operator in respect of the jugular vein or temporal artery, for it is not perhaps of so much consequence from what part the blood is taken, as whether you take the proper quantity. Some, indeed, have said that, in point of fact or effect, there is no such thing as local blood-letting. This position does not appear to be correct, but we are often apt to infer erroneously in respect to the immediate depletion of vessels, and causing blood to be diverted away from the channels into which it is flowing.

Purging next to bleeding seems one of the most important items in the treatment of apoplexy; but we are often prevented from getting down any thing of much bulk or substance, by the closed state of the mouth, and the interrupted deglutition. In this case some calomel may be introduced forcibly upon the tongue, or, what gives us a better chance of speedy operation, two or three drops of the croton oil may be introduced in the same manner.

In respect of emetics opinion varies: it has been supposed that the collapsed oppressed state of the system, which they occasion, is likely to prove an impediment to restoring the brain's energy. In most instances however the stomach pump might be employed; and, should the apoplexy have been induced by any poisonous substance taken into the stomach, or should the disorder be one simulating apoplexy from poison or spirituous liquors, we may do a great deal of good; and if that is not the case we cannot have done much harm.

Stimulant enemas, as the following, may be thrown up the rectum.

℞ Vini aloes f. ℥iij.
Aquæ puræ f. ℥x.

Fiat enema.

Take of wine of aloes three fluid ounces, water ten fluid ounces. Mix them and make an enema.

Or the turpentine enemata may be employed.

℞ Ol. terebinth. f ℥iij.
Aquæ menthæ pip. f. ℥x.

Fiat enema.

Take of oil of turpentine three fluid ounces, peppermint water ten fluid ounces. Mix for an enema.

Or a few drops of the Croton oil may be mixed with a small quantity of crumb of bread, and be introduced into the rectum as a suppository.

After bleeding and purging, blisters may be applied to the nape of the neck, or to the calves of the legs; and, should the insensibility continue, it is usual to apply sinapisms of mustard and crumb of bread, made into a poultice with vinegar, to the feet and ancles. It is doubtful, however, whether much good is ever effected in the powerful kinds of apoplexies by these stimulants and counter-irritants, and the practitioner rather has recourse to them with a view of satisfying anxious and distressed friends and relations than with much hope of their proving efficacious.

The head should be kept cool by the application of a spirituous lotion should morbid heat be generated, and nothing is perhaps better for this purpose than a mixture of spirits of wine and water, or, in the absence of it, common gin and water. If we have recourse to a pharmaceutical composition for this purpose, the proportion of seven ounces of the liquor. ammon. acet. with one ounce of the nitric ether, or half an ounce of sulphuric ether, will answer our purpose (see *Phrenitis*).

We scarcely need go into the requisites of treatment during the progress of recovery from the paroxysm. Should febrile heat prevail, saline aperients and refrigerants are to be administered, as in the case of other febrile complaints; the bowels preserved gently open; and, in the instances of threatened collapse or sinking, the subcarbonate of ammonia should be administered, as directed under the head of fever.

'Apoplexy being so very fatal a disease, it is incumbent on the physician, in all cases where he has reason to suspect a predisposition to it, to employ steadily such prophylactic measures as are calculated to avert the danger. A cool spare diet, abstinence from all fermented or spirituous liquors, regular exercise, abridging the usual number of hours allotted to sleep, keeping an open body, and in some instances establishing a drain by means of an issue or seton, are those on which his chief reliance is to be placed.'—Gregory.

It will be necessary, says another author, to enquire into the state of the viscera during the after treatment; if these have obviously been deranged, before the occurrence of the paroxysm, they must be especially attended to; and the stimulants, which it may be thought necessary to administer, require, for the most part to be modified and corrected by that class of medicinals that are termed deobstruent or alterative; which are, in fact, those that by acting gently and generally upon the secretions obviate as much as may be the disposition to these irregular impetuses of the circulation.

389. *Palsy.* Paralysis.—In reference to palsy the reader is requested especially to advert to and recognise the habits of the nervous system, as pointed out in the preliminary extracts from authors on the several kinds, and species, and grades, and complexions, of nervous disorder.

Symptoms.—Palsy is characterised by an abolition or suspension of voluntary power, or of sensation, sometimes of both, preceded sometimes by a numbness and sense of weight in the head, or vertiginous affection; sometimes a sense of creeping, or numbness, precedes the full attack; and occasionally there is a twitching or catching of the member affected. It has been supposed that when paralysis is thus ushered in by nervous feelings, such as those just mentioned, the disease is then in some portion of the nervous system unconnected with the brain; but when it occurs suddenly, or without these precursors, that then the effect has been brought about by some prior condition of the cerebral system.

Causes.—The predisposition and excitants of palsy are for the most part minor degrees of those which dispose to and excite apoplexy. Sometimes, however, as may have been inferred from what has been previously remarked, the paralytic disorder is purely local and independent of the cerebral system, as when it is induced by a diseased condition of the nerve supplying the muscles which become paralysed; at other times a particular poison, as of lead, will bring on palsy without any obvious effect upon the brain; occasionally the disorder is purely sympathetic, as in the instance of paralysis from worms; at times a certain kind of rheumatism will engender paralysis; and it has been already remarked that some pathologists, from the alliance of rheumatism and palsy, have proposed to designate some kinds of rheumatism, paralytic. The direct application too of cold will, under certain circumstances, create a disordered condition of the sentient and moving organs, which would be justly entitled to the appellation of paralysis, and that without occasioning any obvious derangement in the encephalon; so that palsy is at times a sort of minor apoplexy, or a degree of the same disorder, and at other times apparently independent of the brain.

Distinctions.—Palsy is distinguishable from apoplexy by the absence of stertorous breathing, and by the loss or suspension of sense and motion being only partial. The distinction between cerebral and merely sympathetic palsy must be taken from a careful attention to the circumstances of the attack, by enquiring into the condition of the chylopoietic organs, by ascertaining whether there be any reason to suspect the existence of worms, and by learning whether there are any other particulars con-

nected with the attack beside cerebral disturbance.

Prognosis.—That palsy which results from fully formed apoplexy is seldom thoroughly cured; or, if the muscular energies and volition be restored, it is often at the expense of lesion of the intellectual faculties. It has been remarked that when cerebral or apoplectic palsy, if we may so express ourselves, occurs on the left side, the chance of restoration is less than when the right side is affected. When the paralysis is from causes acting upon the nerves only, the parts have been restored occasionally to their wonted sensation and motion by the occurrence of a fever—which by the way has been known to produce a temporary cure, even of idiotcy, or rather total loss of memory; but the condition that had been removed has been found to recur when the fever subsided. A remarkable case of this kind is related in the Edinburgh Review, if we recollect right, quoted from Mr. Tuke, the proprietor of a lunatic asylum. These mutations and suspensions of disordered states, by the intervention of others, are among the most extraordinary and interesting phenomena that are manifested in connection with morbid processes. The unfavorable circumstances and prognosis in palsy are the simultaneous deprivation of both feeling and motion, with a gradual wasting of the affected limb. The palsy we may say that results from an affection of the brain is always likely to be more permanent, and less under the influence of remedial measures, than that occurring as a mere nervous affection.

Treatment.—Should there be much plethoric condition, or seeming congestion of vessels, bleeding and active purgatives will be required, as in apoplexy. On the other hand, if the deprivation of power be rather nervous than cerebral, rather adynamic than apoplectic, stimuli will be called for, such as blisters, electricity, or galvanism, friction, and the several medicinal excitants that are employed to rouse nervous energy, such as mustard seed, horse radish, ammoniated tincture of guaiacum, carbonate of ammonia, valerian, assafœtida, &c.

Prescriptions from Dr. Gregory, Dr. Hooper, and Dr. Uwins.

℞ Infusi cascarillæ f. ʒviij.
Ammoniæ subcarb. gr. v.
Confect. aromat. ℈ß.
Sp. armoraciæ comp. f. ʒij.
Fiat haustus: ter de die sumendus.

Take of infusion of cascarilla eight fluid drachms, subcarbonate of ammonia five grains, aromatic confection ten grains, compound spirit of horse-radish two fluid drachms. Mix into a draught.

℞ Confectionis aromat. ℈j.
Ammoniæ subcarb. ℈ß.
Aquæ puræ f. ℥iß.
Fiat haustus.

Take of aromatic confection a scruple, subcarbonate of ammonia ten grains, water a fluid ounce and a half. Mix into a draught.

℞ Guaiaci pulv. ℈ß.
Tinct. guaiaic ammon. f. ʒi.
Pulv. acaciæ ℈ij
Syrupi croci f. ʒiß.
Aquæ pimento f. ʒxiij
Fiat haustus.

Take of guaiacum in powder ten grains, ammoniated tincture of guaiacum a fluid drachm, powder of gum arabic two scruples, syrup of saffron a fluid drachm and a half, pimento water thirteen fluid drachms. Make into a draught.

Valerian, in the form of ammoniated tincture, is an excellent medicine; or valerian root may be infused in the proportion of a quarter of an ounce to half a pint of water, and half this quantity taken twice a day. It is questionable whether the virtues of valerian may not be too little regarded in the present day; but, upon the whole, we are not to expect a great deal from stimulants of this kind as permanent medicinals. In old cases, where the secretions as well as the nervous energy may be out of sorts, a combination of guaiacum with deobstruents, as in the following formula, may be tried.

℞ Guaiac. resin. ʒij.
Pil. hydrarg. ʒj.
Pulv. digitalis ℈j.
Opii pulv. ℈ß.
Mucilag. acaciæ q. s.
Fiat massa in pilulas xlij dividenda. Suma ij vel iij nocte maneque.

Take of guaiacum two drachms, blue pill one drachm, powder of foxglove one scruple, powder of opium half a scruple. Mucilage of gum arabic as much as will be sufficient to make into a mass, which is to be divided into forty-two pills, two or three to be taken at night and morning.

The nux vomica, the arnica montana, and the rhus toxicodendron, have all been tried in palsy, especially the former, and they unquestionably possess an influence over the nervous system; it may, however, be considered doubtful, whether any of them are gifted with influence of a permanent kind in old standing palsies, and whether the temporary excitation which they occasionally produce may not in some instances prove worse than useless. Certain it is that, when the palsy has connexion with chronic irritation in the brain, there is some danger of stimulating the vascular as well as the nervous system by means of these medicinals, to an extent destructive of our own design in their administration. This objection lies against the voltaic electricity, if unseasonably, or without due care applied; but upon the whole we should say that galvanism under proper regulations promises to be of more service in some cases of old standing palsy than any remedy which has hitherto been proposed. Bath waters, warm sea bathing, vapor baths, with or without medicinal impregnations (and these impregnations are of questionable efficacy) shampooing, and a determined course of friction, seem principally useful when the paralysis partakes of an arthritic, that is, of a gouty or rheumatic character; for in stiffness and want of power over the limbs, connected with these dispositions and states, much good may be effected by a judicious employment of one or more of these several remedial processes; they combine the advantages of exciting hope and in-

spiring confidence, with their more positively physical operation; and the reader will recollect the curious fact, stated in the introduction to the present class of diseases, that supposed metallic tractors, while they were employed under the conception on the part of the patient of their being the real thing, operated a decided and powerful effect upon muscles which refused to be called into action by the common excitants of muscular energy.

In all cases of remedial attempts to overcome palsy we must be careful to keep the secretions active, and not to stimulate the brain to an excess.

The following composition may be employed with much benefit in some cases of chronic palsy, particularly where there is still a disposition manifested to cerebral irritation.

℞ Decoct. aloes comp. f. ℥vj.
Ammoniæ subcarb. gr. v.
Aquæ puræ ℥vj.
Fiat haustus.

Take of compound decoction of aloes six fluid drachms, water six fluid drachms, subcarbonate of ammonia five grains. Mix them into a draught.

The student will perceive, by turning to the nosology, that paraplegia is one of the varieties of palsy pointed out by Dr. Cullen. This name is given to a loss of power over the lower extremities, or, as it is expressed, half the body divided, not as in hemiphlegia, but transversely. Much discussion has taken place in respect of the condition of parts necessary to the production of this species of palsy, when it occurs without an obvious affection of any portion of the spinal chord. Dr. Baillie has brought forward arguments in support of the principle that this is a cerebral palsy as well as hemiplegia; and he has adduced the facts that giddiness, drowsiness, vertiginous affections, &c., accompany it. The probability, however, is, that it may at different times be both cerebral and spinal; that is, that some altered condition of the spinal chord, without being obvious to the senses may prove, occasionally equal to the production of this kind of paralysis without any primary affection of the brain, and that at other times the original cause of the paralysis may be in the brain, and the direction of it to the lower extremities regulated by the particular parts of the brain which may be implicated. Affections of the spinal chord, and its investing membranes, we may here take occasion to say, have been recently investigated with considerable minuteness, and no examination as to structural change is at present considered satisfactory; we mean more especially in reference to nervous changes, that do not take the spinal appendage to the brain, as well as the brain itself, or as it is called by some the cerebral brain into recognition.

The following is an outline lately given by Dr. Abercrombie of the general pathological changes of which the spinal chord is susceptible. For the record of cases illustrating the principles we must refer to the work itself of Dr. A., which is entitled Practical Researches on Diseases of the Brain and Spinal Chord; a work from which we have already made a considerable extract in the introduction to the present class of morbid affections.

1. Acute inflammation of the membranes, or what we call meningitis, of the chord.

2. Inflammation of the body of the chord terminating by ramollissement or suppuration.

3. Serous effusion in the spinal canal.

4. Extravasation of blood in the spinal canal, or spinal apoplexy.

6. Fungoid disease and thickening of the membranes.

6. Induration of the chord.

7. Compression of the chord by new formations within the canal, as tubercles, albuminous depositions, hydatids, and ossifications of the membranes.

8. Destruction of a portion of the chord.

9. Concussion of the spinal chord.

10. Certain affections of the bones of the spine.

We do not mean to say that the above affections of the spinal chord are causes producing, or circumstances in connexion with paraplegia; we merely embrace the opportunity, which no part of the nosology better affords us, of reminding the reader of the connexion between spinal and cerebral ailments, and of the necessity of preserving in the recollection a view of this connexion when the different shapes of palsy are made the subject of pathological enquiry as to their nature and seat and rationale. At the same time let us again remind the student that paralysis of all kinds, and in all localities, oftentimes presents itself without any morbid manifestation of a structural or local kind whatever, and when we take into account that a complete paraplegia of a temporary kind will be consequent upon a few ascarides in the rectum, which will yield with the destruction or expulsion of these animalculæ, we must acknowledge that many changes take place in the nervous system which morbid anatomy cannot discover, but which pathology must carefully collect and appreciate.

The difficulties (says an author whom we have already so many times quoted in the present article) which we have to encounter, in any enquiry into the pathology of paralysis, are greatly increased when the investigation is extended to those cases of general and partial palsy which are to all appearance totally unconnected with any derangement of structure, or function, in the encephalon. That such cases do occur is unquestionable; and it must be left to future enquiries to determine in what manner these apparent inconsistencies are to be reconciled.

In the year 1820 I had an opportunity of seeing an instance of general palsy, of the kind now alluded to, the history of which is fully detailed in the London Medical Repository. The disease ran a very singular course, terminating after the lapse of about eight months in the complete recovery of health. During the whole of this long period, there did not occur one symptom which could warrant me in looking to the brain as the source of the disorder. The vital and natural functions were also undisturbed, nor was there any evidence of disease within the theca vertebralis. It is obvious, therefore, that this disease was in its pathology totally distinct from the or-

dinary forms of palsy. A case very similar in its leading symptoms, but different in its termination, is recorded by Dr. Powell in a paper containing many important pathological views of palsy. We bring forward this case among others in support of the opinion that paralytic affections, both partial and general, often originate in a peculiar condition of the nerves alone; that they are independent of any morbid affection of the blood-vessels of the head: and that they are produced in many instances by cold, and in some by sympathy with particular states of the stomach, or other distant local irritations.

The palsy from lead is the one to which Dr. Cullen particularly alludes in his variety entitled Paralysis Venenata; but, as we shall have occasion to speak of the effects of lead under *Colica Pictonum*, we need not in this place enlarge on this variety.

390. Order 2. Adynamic Disorder. Adynamiæ.—Adynamia is a vague term to apply to an order of diseases, since there are very few affections which the term would not characterise, the strict meaning of it being deficient power. The genera of the order are fainting (syncope), dyspepsia, hypochondriasis, and chlorosis (green sickness).

391. *Fainting*. Syncope.—Fainting is sometimes nervous, strictly so speaking; at other times it is organic, or dependent upon some affection of the heart. 'To maintain the faculty of perception clear and true to the impressions that are made on the external senses, the motion of the nervous power which connects it with those senses must be equable and uniform; and, to maintain the action of the heart in a firm and regular order, it is necessary that the blood should flow into it in an equal and uniform stream; for if its volume be altered from any cause, whether of obstruction, surcharge, or deficiency, its motion will be checked and enfeebled; the brain and respiratory organ will participate in the debility, and syncope be a frequent result. And hence we may account for the fainting which frequently takes place on the commencement and sometimes on the close of venæsection. On tying the arm for this purpose a considerable stream of supply is cut off, and ten ounces of blood flow, in perhaps five minutes, into a basin, which would otherwise have flowed into the heart in the same period of time. The volume of blood is hence diminished, and the heart must collapse or contract itself in proportion. In many habits this is done with great facility, but in others, and especially where there is a feeble supply of motific or irritative power, the contraction takes place slowly and irregularly, and with a considerable degree of flutter, or clonic spasm; and fainting or a temporary failure of sensation is the necessary consequence; during which the alternating systole is very feeble, and the blood ceases to flow at the puncture. This effect is ordinarily ascribed to a loss of the stimulus of distension, and there may be some degree of truth in such an explanation. But that there is something beyond this is certain; because, on removing the ligature from the arm, this stimulus is once more obtained; for the blood, instead of flowing away at the venous orifice, now takes its proper course and flows back to the heart. Yet we see almost as often a syncope produced at this moment, and consequently by a revival of the distension, as well as by an interruption of it. The fact is, that the heart, which by this time has accommodated itself to the diminished volume of the returning current, has now once more to change its diameter, and to expand itself in proportion to the increased measure and momentum of the in-flowing tide; and as a change in its diameter produced a syncope in the former case, a change in its diameter in like manner produces it in the latter.

For the same reason we see swooning takes place when any extensive range of blood-vessels that have been pressed upon by every other means suddenly acquire a power of dilatation; as when a large cavity is formed in the abdomen by the process of tapping for an ascites, or on opening an extensive abscess in any other quarter.

But the flow of sensorial power from the brain may also be suddenly exhausted or checked, or perhaps its secretion impaired; and syncope may ensue from this source, the action of the heart being diminished not primarily but secondarily, or by sympathy with the state of the sensorium. In fainting from entonic passions or emotions, as a sudden shock of vehement joy, the sensorial power is perhaps abruptly expended as also in severe pain. In fainting, under the influence of atonic passions, as fear, or heart-sick grief, this power is unquestionably checked in its regular flow, and probably checked also in its secretion; (it will be observed that the author, whom we are now quoting, speaks of the nervous power as effected through the agency of a secreted fluid, as being indeed a nervous fluid,) as we have reason to believe it is where fainting occurs from a repulsion or retrocession of gout, exanthems, or various other diseases. And to the same cause may be referred those cases of swooning which in some idiosyncracies, or indispositions of body, are well known to take place on exposure to particular odors, as those of cheese apples, of roses, lilies, and other fragrant plants. Where it has followed instantly upon acrid poisons, there can be no doubt that these have induced a rigid or entastic spasm upon the muscular fibres of the heart; and, where the poisons are purely narcotic, the living or instinctive stimulus is suddenly extinguished or carried off, and the nervous system becomes an exhausted receiver.

Syncope then in its simple state, as unconnected with any structural disease of the heart or its adjoining vessels, seems to appear under the following modified forms or varieties:—α. Inanitionis (from inanition). The swooning produced by fatigue, long fasting, or a sudden and excessive discharge of any fluid whether natural or morbid, accompanied with a sense of inanition and great prostration of strength. β. Doloris (from pain), preceded by severe pain or irritation of body; internal, as from poisons, flatulency, or worms; or external, as from wounds, or other injuries. γ. Pathematica (from mental emotion), preceded by an exercise of some sudden and overwhelming passion or emotion. δ. Metastatica, accompanied with a

retrocession or repulsion of gout, exanthems, or other diseases.

The degree and duration of the paroxysms depend upon the peculiarity or violence of the cause, the extent of the sensorial exhaustion, or the nature of the constitution, and hence must greatly differ in different individuals. In some cases it ceases in a few minutes, and the patient, though incapable of speaking, retains enough of perception and sensation to be conscious of his own disorder, and to understand what is passing around him. The pressure and irritation of flatulency, in dyspeptic and hypochondriacal habits, are often sufficient of themselves to produce a fainting of this kind. In other cases the general feeling and understanding fail totally, and the pulse is scarcely perceptible. Occasionally the sensorial power has been totally, as well as suddenly exhausted, and the syncope has run into asphyxy, and even proved fatal

When not assisted by medicine the system recovers itself by the gradual accumulation of sensorial energy that must necessarily take place so long as the living principle continues during such a state of quietism; aided unquestionably by the continued action of the instinctive or remedial power of nature, which is always aiming to repair what is amiss. The process of recovering, however, varies almost as much as that of sinking. Some revive almost immediately without any inconvenience or sense of weakness whatever; while others improve slowly and almost imperceptibly, and require many hours before they fully regain their self-possession. In various cases the head becomes clear as soon as the pulse becomes regular; while, not unfrequently, the recovery is accompanied with a confusion of ideas, vertigo, and head-ache.

As this disease is always attended with an irregularity in the flow of nervous power, and some degree of spasmodic action, entastic or clonic about the heart, the best remedies we have recourse to, during the paroxysm, are antispasmodics and stimulants; and those that are the most volatile are the most useful. Hence the advantage of admitting a free current of cold air, sprinkling cold water over the face, and pouring a little of it if possible down the throat. And hence also the advantage of holding ammonia, the strongest vinegar, or any other pungent odor, to the nostrils. A recumbent position is always advisable as most favorable to an equable circulation of blood; and irritating and warming the extremities by the friction of the hand, or the application of rubefacients, will commonly be found to expedite the recovery, upon the principle that, in a chain of organs united by sympathy or continuity, an impression produced on the one extremity is sure to operate on the other. As soon as the patient is capable of swallowing some spirituous cordial, as a glass of wine or brandy and water; fetid tincture, or the aromatic spirit of ammonia, or of ether, should be administered, and the occasional cause should be sedulously avoided in future.—*Good.*

392. *Dyspepsia.* Indigestion.—To describe the symptoms of dyspepsia would be to run over the whole ground of nervous feelings. The dyspeptic is hypochondriac, has wandering pains over his body, and uneasy sensations about his limbs, as well as immediately in the stomach and connected viscera; his countenance looks dejected; the surface of the body loses its healthy complexion; the secretions and excretions are irregular; the tongue is foul and clammy; and, in a word, the whole system in a state of derangement.

Causes.—The existing causes of indigestion are generally sufficiently obvious. Alternations of temperature, affections of the mind, spirituous liquors unduly taken, the immoderate use of tea, a sedentary life, intemperate study, and in fact all excesses which tend to deprive the system of power will have the effect, in the dyspeptically disposed, of interfering with the digestive process, as well as the more obvious and necessary sources, those of eating too much, or taking food of an improper quality.

With respect to the proximate cause of indigestion, or the circumstances by which it is constituted, it evidently consists, in the first instance, of a disordered condition of the muscular fibres of the stomach, and a disordered secretion from the villous coat of the organ; hence the ingesta, instead of being duly acted upon mechanically, chemically, and, if we may so say, vitally, run into those changes which unorganised matter is obnoxious to; fermentations take place, eructations of gas are the consequence; pains of the stomach are brought on, partly by the irregularity in the fibrous action of the stomach, and partly by the acrimony of its secretion, and of the undigested mass: a general morbid susceptibility is induced, connected with want of muscular energy; this torpor is extended to the duodenum, and to the liver, and to the pancreas,—the functions of these organs are in consequence performed lamely; in this manner the original disorder of the stomach is both extended to other parts, and increased in the organ itself first affected; the cerebral system of sympathetic nerves partakes of the deranged condition, and thus sympathetic grows out of local disturbance, and the whole frame, as we have said, comes to participate in the induced affection.

Dr. Wilson Philip, who has written expressly on indigestion, divides it into three stages; the first, in which the stomach itself is alone or principally injured in the way just pointed out, of mere functional or nervous, and muscular and secretory derangement; in the second stage he supposes an inflammatory condition to have been induced, marked by epigastric tenderness and hard pulse; and in the third consecutive disorders are occasioned, and the dyspeptic becomes phthisical, or otherwise disordered, according to constitutional tendencies or accidental circumstances.

Dr. Paris, Dr. James Johnson, and Dr. Uwins, who have all recently written on disordered digestion, contend that the inflammation assumed by Dr. Philip is for the most part mere tenderness, and they deny that any thing like this regularity of division into stages does in point of fact obtain. At the same time they allow that inflammatory threatenings, and phthisical, as well as other tendencies, should be watched over and counteracted, and he that

should confine his observations to the mere condition of the stomach itself, under circumstances of dyspepsia, would take by far too limited a view of its nature and remedial requisites.

Dr. Mason Good, too, dwells particularly on the necessity of extending our views out from the mere stomach derangement, and taking into account the condition of the intestines, the liver, the pancreas, and the spleen. The debility, and indeed torpitude, of the intestinal canal, is evident, he says, from the habitual costiveness which so peculiarly characterises this affection. Whether this be direct or indirect, intrinsic or sympathetic, as harmonising with the weakness of the stomach, it is not easy to determine; but nothing can be a stronger proof of the great inactivity of the intestinal tube, from whatever cause produced, than the feebleness of its peristaltic motion, notwithstanding the pungency of the acid, and other acrimonious matters, that are so frequently formed in the stomach, and hence so frequently diffusing their asperity over its inner surface.

The imbecility of the liver is equally obvious in most cases from the small quantity of bile that seems to be secreted, or its altered and morbid hue as evinced by the color of the fæces, which in some instances are of an unduly dark, and in others of an unduly light tint, and possibly from the inactivity of the intestines themselves, whose peristaltic motion is in a great measure kept up by its stimulus.

It is highly probable that the pancreas and spleen are both also affected in many cases of dyspepsia. We know that the pancreas pours forth a considerable portion of the fluid which holds the solid part of our aliment in solution; while in most cases of dyspepsia, brought on by a habit of drinking spirituous liquors, the spleen is evidently affected as well as the liver.

Distinctions.—Hypochondriasis and dyspepsia are said by the dividers of disease to be different, inasmuch as the former is a disorder of the nervous system, which only brings the digestive organs into consecutive sympathy, while the latter is a complaint of the stomach originally, and the nervous system is the part secondarily affected. It is also predicated of hypochondriasis that it affects principally individuals of a melancholic temperament, while dyspepsia is common to all constitutions. The student will, with a recollection of these intimations, which have in the course of the present article been more than once given, respecting the nature of medical nomenclature, know how far to care about these niceties of nominal distinction. It is, however, always right both in reference to pathology and practice to endeavour at tracing the first link in the chain of morbid association, or to ascertain the primary locality of affections that are thus located both in a primary and secondary way.

Prognosis.—From mere derangement in the digestive process much is not to be dreaded, unless it continue, and in its protraction come to elicit latent disorders of the frame that only awaited an excitant to develope themselves. Dr. Wilson Philip has argued at length in support of a dyspeptic phthisis, and has replied to others who are a little inclined to speak contemptuously of this designating precision; and it must be allowed that an individual with a phthisical tendency, ready to break out upon any exciting cause, may have consumption establish itself as the result of a stomachic derangement; this last having been formidable and protracted. Organic affections of the stomach, as schirrous pylorus, may also be engendered by the long continuance of dyspepsia; but it must be allowed that these specific diseases often occur during the time when the digestive process is no otherwise interrupted than as a consequence of the disorganisation referred to.

Treatment.—It is especially requisite for the dyspeptic to relinquish with determination and perseverance those practices which have induced the disorder; intemperance of all kinds must be given up, even immoderate studies: indeed than these, connected with the anxiety of mind which frequently accompanies them, there is not probably a more fruitful source of the malady now under notice. It is the position of the body also that partly operates unfavorably under these circumstances. Severe and long continued study, says Dr. Good, who himself was a hard student, protracted as I have known it through ten hours a day for many months, without any relaxation or change of pursuit, must give way to the exercise of walking or riding, and this not occasionally but daily, and to the still better cordial of cheerful conversation. The last is of very great importance, and without it even exercise itself will be of little avail; for the mind, accustomed to a certain track of intellectual labor will otherwise relapse, even while riding or walking, into the same habitual course, be dead to the most fascinating prospects around it, and become exhausted by its own abstractions. And it is to characters of this kind perhaps, more than to any other, that the amusements of a watering place promise ample success; where the general bustle and hilarity, and the voluntary forgetfulness of care, the novelty of new scenes and new faces, and new family anecdotes, and the perpetual routine of engagements that fill up the time with what would be otherwise trifles and frivolities, reverse the mischievous order and monotony of the past, break the sturdy chain of habit and association, and give occasion to the worn out sensory to refresh itself.

Mere change of air, as well as of scene and amusements, is often wonderfully forcible in breaking into the morbid links of the chain of diseased actions, which constitute the worst forms of dyspepsia, and a very short removal, even from one part or outlet of the town to another, will often effect a considerable share of good. I have known, says Dr. Uwins, individuals who have felt themselves vaporish and dull, and dyspeptic, when residing in Westminster, to become, comparatively indeed, conspicuously free from their complaints as soon as they shall have removed to the north-west suburbs; but there is something inexplicatively operative at times in mere change of air, when the new atmosphere may not abstractedly be so salubrious as the one left.

With respect to the medicinal indications, in

dyspepsia, they are obviously to rid the stomach of the offending material, and to get the muscular and secretory tone of the organ into that state of vigor which shall insure against future loads of unhealthy secretions. Emetics are occasionally required, either of ipecacuan or sulphate of zinc, a scruple or half a drachm of this latter often doing the good that the ipecacuan or antimonial emetic refuses to accomplish. Gentle purgatives are also of course requisite; and, when the liver is obviously engaged with the disordered condition, it is right to combine with the purgative material some blue pill, or small doses of calomel. It is right also, when thinking of purgative medicinals, to take into account the morbid susceptibility of the nerves and organs implicated, otherwise, by employing indiscriminately drastic materials to dislodge offending colluvies, we may defeat the object for which we instituted the cathartic process, and add to rather than abate irritation. For the sake of accomplishing this combined intention of allaying irritation, while we produce evacuation, some one of the vegetable narcotics may be advantageously combined with the purgatives, of which few formulæ will be found more efficacious and applicable in most dyspeptic states than the following.

℞ Extract. hyoscyami ʒß.
Extract. colocynth. comp. ʒj.
Hydrarg. submuriat. gr. ij.

Fiat massa in pilulas xxiv. dividenda; quarum sumat æger ij vel iij semel, bisve in die, ut opus erit.

Take of extract of henbane half a drachm, compound extract of bitter apple a drachm, calomel two grains. Mix them into a mass, which divide into twenty-four pills, and let two or three be taken once or twice a day according to circumstances.

Exceedingly small doses of calomel, such as will be found in the above formula, or the addition of only one grain of blue pill to other purgatives, will not seldom prove highly useful to the dyspeptic, whose morbid irritability of stomach would reject, or at least be injured by, larger quantities of mercurials; and some persons, dyspeptics particularly, have an extreme sensibility to mercury, when given in any beyond very minute doses.

Acidities must of course be corrected by one of the alkalies, or magnesia; the last is often exceedingly applicable to dyspepsia, for while it corrects the stomach acidities, it forms a salt with such acidity that is purgative, and when the dyspeptic condition is connected with the tendency to gravel, which is not seldom the case, a tea spoonful of the common or subcarbonate of magnesia, taken about twice a day in a glass of cold water, will do much good.

The more positive alkalies, as of soda and potass, will also prove beneficial in correcting the acidities of the stomach; and for the most part it is best to employ the mild or aërated alkalies, than the caustic or pure.

Acids also will occasionally be found good correctives of stomach disorders, even although the condition which they are given to counteract is one of acidity. But, as remarked by Dr. Good, it is not always from acid formation that the dyspeptic suffers. The eructations, says this author, are often of a compound and very offensive taste, and give to the breath the smell of carbureted hydrogen gas, or rotten eggs; as though the gastric juice were incapable of performing its proper office, and the food were retarded in the stomach till the process of putrefaction had commenced. In this case, instead of avoiding acids, we should recommend a free use of them, from whatever quarter they may be obtained, as they not only tend to correct the fœtor, but to strengthen the stomach. The mineral are the most powerful; and of these the sulphuric is by far the pleasantest; but, in common with the rest, it labors under this disadvantage, that only a small quantity of it can be taken at a time, because of its corrosive quality. It may be advantageously employed as a medicine, but for acidulated diet-drinks it must yield to the vegetable acids. These are of three kinds, native, distilled, and such as are obtained by fermentation. The first are commonly the most grateful, and especially when they exist in the form of fruits; but, as in most of these they are combined with a fermenting power, they are apt in weak stomachs to set free a very large quantity of air, and consequently to produce a very troublesome flatulency, and even promote the ascescent disposition of the organ. The citric and oxalic may be exceptions; and there may also be a few others, but they are not numerous, and where these cannot be procured we must have recourse to the acids elaborated by distillation, or a fermenting process. The last are called vinegars, whether obtained from malt, weak wines, or sugar; and being themselves, when properly refined, very pure and dilute, they are capable, with a little care, of being rendered highly grateful.

The distilled acids of vegetables have not yet been sufficiently tried, to determine whether any of them possess any specific virtue. They were at one time very generally made use of under the guise of tar water, the whole of whose benefits Dr. Cullen ascribes to the acid of the fir with which the tar was impregnated; but I cannot avoid conceiving that some and not a small part of its good effects resulted from the camphorate or terebinthinate principle which was communicated at the same time. Glauber and Boerhaave seem to have been of the same sentiment; and, as the Norway tar is richer in this principle than the American, we are at no loss in determining why Dr. Berkely preferred the former to the latter. This medicine has experienced the fate of every human discovery, whose praise is carried to extravagance; and, from being esteemed good for every thing, it is now esteemed by many practitioners good for nothing, and has sunk into total disuse. But this is to sink it very considerably below its level. There are many complaints for which it has very fair pretensions; and where the taste is not disliked it will be found a useful remedy in indigestions attended with offensive and putrid eructations.

Having thus expressed himself on the subject of tar water, Dr. Good goes on to the mention of

another remedy which is but little employed as an anti-dyspeptic, but of which some have spoken highly. We may observe by the way that this remedy (charcoal) has likewise obtained the reputation of being the best material for obviating some kinds of costiveness; the dose may be from half a scruple to a scruple, repeated three or four times a day.

By way of restoring tone to a dyspeptic stomach, bitters and other tonics are had recourse to, and occasionally with considerable advantage: in their administration however, we must be careful not to induce the habit of dependence upon these kinds of fillips, and we must likewise withhold them when there is much febrile irritation, with hardness and quickness of pulse. In all cases it may be as well to combine them with slight aperients, so as that their too stimulating action may be obviated; and when we have reason to suppose the sluggishness or irregular action of the stomach has extended itself to the liver, the addition of what in the humoral school of medicine are called alteratives may be still further called for. We shall here put down a few formulæ for answering these different indications.

Antacid, and aperient, and cordial, from Dr. Hooper.

℞ Potassæ subcarb. ʒiß.
Myrrhæ contus. ʒj.
Aloes soc. ʒiß.
Croci ʒß.
Aquæ distill. Oj.
Coque ad ℥xij et liquori colato adde
Tincturæ Cardam. comp. ℥iv.
Syrupi zingiberis ℥iß.
Sit dosis cochlearia duo magna bis die.

Take of subcarbonate of potassa a drachm and a half, bruised myrrh a drachm, Soccotrine aloes a drachm and a half, saffron half a drachm, distilled water a pint. Boil them down to twelve fluid ounces, and to the strained liquor add compound tincture of Cardamum four fluid ounces, syrup of ginger a fluid ounce and a half. Let the dose be two table spoonsful twice a day.

Very similar to this is the decoctum aloes compositum of the Pharmacopœia two table spoonsful of which may be taken twice a day. It is for the most part better to add three or four grains additional of soda to that proportion of alkali which the Pharmacopœia orders, more especially if the acidity of the stomach is considerable.

Soap pills with rhubarb, as antacid and aperient.

℞ Saponis duri,
Sodæ subcarbonatis exsic., āā ʒj.
Pulv. Rhei ʒß.
Aquæ q. s.
Fiat massa in pilulas xxxvj dividenda. Sumat iij nocte maneque, vel omni nocte.

Take of Castile soap and dried subcarbonate of soda of each one drachm, powder of rhubarb half a drachm, water as much as is sufficient to form a mass, which make into thirty-six pills, three to be taken every night, or night and morning.

This last prescription will be found exceedingly applicable when affections of the kidneys accompany disordered states of the stomach.

Stomach tonics with gentle aperients.

℞ Infus. quassiæ f. ℥iß.
Magnesiæ sulphat. ʒj.
Tinct. rhei f. ʒiß.
Fiat haustus: bis die sumendus.

Take of infusion of quassiæ a fluid ounce and a half, Epsom salts a drachm, tincture of rhubarb a fluid drachm and a half. Mix into a draught, to be taken twice a day.

℞ Ferri ammoniat.,
Pulv. rhei, āā ʒj.
Aquæ puræ q. s.
Fiat massa in pilulas xxxvj divid. Sumat iij bis in die ante et post merid.

Take of ammoniated iron and powder of rhubarb of each a drachm, water enough to form a mass, to be divided into thirty-six pills; three to be taken forenoon and afternoon.

Deobstruent and stomachic.

℞ Extracti taraxaci ʒß.
Sp. ætheris nitric f. ʒj.
Infus. gentianæ comp f. ℥iß.
Fiat haustus: bis die sumend.

Take of extract of dandelion half a drachm, spirit of nitric ether a fluid drachm, compound infusion of gentian a fluid ounce and a half. Make them into a draught to be taken twice a day.

The above are more particularly called for when there is reason to suppose the liver requires to be stimulated or emulged.

Antacid and aperient and stimulant.

℞ Magnesiæ subcarb. ʒß.
Sp. ammoniæ aromat. f. ʒi.
Aquæ puræ f. ℥iß.
Fiat haustus.

Take of common magnesia half a drachm, compound spirit of ammonia a fluid drachm, water a fluid ounce and a half. Make them into a draught.

A good stomachic under circumstances of a tendency to gouty affection.

When violent pains accompany stomach affection, so as to constitute what in the schools would be called gastrodynia, the oxide, or what is now more properly termed the subnitrate, of bismuth will be found a useful medicament; it may be given in conjunction with rhubarb.

℞ Bismuth subnitrat. gr. vij.
Mucilag. acaciæ f. ʒiij.
Tincturæ rhei f. ʒiß.
Aquæ menthæ pip. f. ℥iß.
Fiat haustus.

Take of white oxide of bismuth seven grains, mucilage of gum arabic three fluid drachms, tincture of rhubarb a fluid drachm and a half, peppermint water a fluid ounce and a half. Mix into a draught.

Than tincture of rhubarb, in small quantities, very few medicinals are more suitable to a dyspeptic invalid. The Chlorine bath, mentioned under the head of chronic hepatitis, may be

employed in obstinate cases with a prospect of good.

When diarrhœa occurs in dyspepsia, five grains of the blue pill may be given at night, and about a fluid ounce of the cretaceous mixture (the mistura cretæ of the pharmacopœia) two or three times a day. A little tincture of rhubarb may be added to the cretaceous mixture, in order to prevent undue constipation following the diarrhœa.

Blisters to the back will sometimes correct a chronically disordered state of the stomach; or with the same view, of procuring a vicarious or metastatic irritation, the antimonial ointment may be rubbed into the hypogastrum every night.

Friction of the surface, warm clothing, cold, warm, or shower bath, according to circumstances are all of occasional use in correcting dyspeptic conditions of stomach. The dyspeptic must be especially enjoined to keep his extremities warm; and he must be urged even against his inclination to walk and ride in the open air. Galvanism under judicious management may be made very useful in some old standing cases of dyspepsia.

[*Note.*—Although we object to the division of Wilson Philip before alluded to, into the first and second stages, or into that which is inflammatory, and into that which is not; yet when much epigastric tenderness manifests itself in connexion with febrile symptoms, it will then especially be requisite to use caution as to the administration of bitters and stimulants, and in their place very small doses of the vinum colchici, of nitre, or even of antimony will be found expedient; the dose of the last requires, when administered as an antidyspeptic medicinal, to be very small, the eighth or tenth of a grain of tartar emetic being often sufficient. The colchicum wine may be given in doses of from twenty minims to half a drachm, and the dose of nitre is from about six to ten grains.]

Respecting diet no very precise rules can be laid down with propriety, inasmuch as the meat of one is the poison of another; but as it might not be expedient to bring this disquisition to a close without some specific regulations on this head, we shall beg leave to extract from Dr. Good his observations in reference to these particulars.

One substantial meal of solid animal food daily is sufficient for a man in full health in a life of ordinary labor. Yet there are many who, without any labor, are from a long habit obliged to take two or even three. But the habit is bad, and cannot too soon be broken through. It follows therefore, of necessity, that, where the stomach is weak, the toil of digesting one full meal of animal food is the most that should be put upon it. This should take place as nearly as may be to the hour of noon, certainly not later than one or two o'clock, so as to occupy the middle of the wakeful period. The animal food should consist of one dish only; and be confined to such as is lightest of digestion, or as the peculiar state of the stomach may call for; for in both these respects there is a considerable difference. Thus shell-fishes do not always agree with weak stomachs, and will sometimes excite great uneasiness, with pyrectic heat, and even throw out a nettle rash, or some other cutaenous eruption. Yet, where they sit easy and are relished, several of them, as the crab and lobster, are found to neutralise acidity in the stomach more readily and effectually than any other kind of animal food: an effect we should little predict, considering that they give out, on a chemical analysis, a smaller proportion of ammonia than the flesh of quadrupeds, birds, or even amphibials. The food of young animals is less nutritive than that of old, but it is, in general, digested with less irritation. Many writers have arranged the different animals that furnish food in tables founded upon their supposed degree of nutriment. But they have drawn them up with considerable variations, in some instances apparently according to their own fancy. I have not space to enter into a comparison of these, nor is it necessary. Those who have leisure for such a study may turn to Dr. Darwin's, which is perhaps one of the best, and which they will find in his Zoonomia. Generally speaking, the tenderest food is that of the gallinaceous birds: then that of the ungulated quadrupeds; among which the stag, or cervus kind, claims the pre-eminence; and to this succeed the ox, sheep, and hare, in the order in which they are here placed. Yet it should be observed that the last, though less nutritive than the preceding, is more easily digested than several of them; as it should also, that the flesh of animals in their wild or native state, though less coveted by a pampered palate, offers a more wholesome and digestible aliment, and is more perfectly animalised than that of animals cooped up and fattened for the table. Below the hare we may place the web-footed birds that are ordinarily brought to market; and below these the oyster and lobster tribes, and lastly the numerous genera of fishes.

The vegetable nutriment should be such as is least disposed to ferment in the stomach, and hence all kinds of new bread, sweet preserves, confectionary, and pastry, must be sedulously avoided; and the crust of bread, toasted bread, and unleavened biscuits take their place. The farinacea, whether seeds or roots, as rice, wheat flour, in the form of light and simple pudding, and potatoes, may be allowed in moderation. Water too is the best beverage; but, where there is great flatulency, a small portion of brandy may occasionally be added. The only condiments that can be conceded are salt and spices: pickles might be admitted where acids constitute a part of the medical treatment; but they are disposed to provoke a false appetite, and hence to weaken the stomach by overloading it.

From fixing the principal meal so near the hour of noon, it is clear that we suppose the day to commence at a very different period from the ordinary regulations of fashionable life; in which the bed is rarely quitted before nine or perhaps ten o'clock, after a night of imperfect and feverish sleep, when the languid idler immediately proceeds to a breakfast of tongue, ham, and eggs in addition to the ordinary materials of this meal, as though he had been already laboring in the field for two hours; and by means of their combined stimulus fills his stomach with a load,

which might indeed do good to the husbandman, but to himself proves nothing more than a mischievous oppression. Yet to this morning toil of the stomach succeeds, at about two o'clock, the ordinary luncheon in a still more solid shape; followed in the evening by a dinner of numerous courses, with high seasoned condiments and a stimulating change of wines; the real business of this vain and frivolous life perhaps not commencing till the better disciplined peasant has begun his quiet sleep: when, roused by a flow of factitious spirits, and primed for gaiety and gallantry, the votary of pleasure, as it is called, sallies forth to join his comrades at the allotted place of rendezvous, and to pass the midnight in hot and crowded ball-rooms, or in orgies of a still more exhausting nature. Of the whole of this career, the only rational part of it is the luncheon a little after mid-day; this may be copied by the invalid before us, as his dinner, but from all the rest we must carefully shut him out. He should quit his bed by six or seven o'clock in the morning in the summer, and by seven or eight in the winter; and after having risen for an hour he may partake of a light breakfast of milk, cocoa, sassafras, or any other aromatic or warm-flavored tea, with toasted bread, the crust of bread, or sea-biscuits, as observed already. The morning may be devoted to such exercises or recreations as may be most agreeable without producing fatigue. To this will succeed the chief meal of the day, upon the plan already laid down; and a light refreshment of the same nature as the breakfast should conclude the daily diet, a few hours before retiring to rest, which should never be later than eleven o'clock. Sea-bathing or the shower-bath, before breakfast, will considerably add to the means of improvement wherever these advantages can be enjoyed, and particularly when the warmth of the season may give them the character of luxuries.

393. *Hypochondriasis.* Low spirits.—This is the next genus to dyspepsia in the nosology, but nothing further can be said of it in connexion with dyspepsia than what has already been advanced. See *Dyspepsia* (distinctions). As far as it is a vesanic, or more strictly mental malady, a remark or two will fall to be made on it in the order of vesaniæ.

395. *Chlorosis.* Green sickness.

Symptoms.—Indisposition to exertion; stomach derangements to such an extent as to excite a desire for some of the absorbent earths; wandering pains; palpitation; and, at length, from a pallid to a green change of countenance and complexion, are the characteristics of chlorosis. Sometimes, indeed pretty frequently, while there is an irregularity with respect to the menstrual discharge, an obstruction indeed of it, the chlorotic female is worried with fluor albus; and this, with other circumstances, adds to her dejection of mind.

Causes.—It usually happens to girls who are of a scrofulous habit; its exciting causes are all such as tend to debilitate and derange. Disappointed love will sometimes engender it.

Distinction.—The obstructed menstruation of chlorosis may be distinguished from that of pregnancy by the absence of that fulness of the whole frame, especially of the breasts, and the want of the dark areola about the nipples which mark the pregnant state. Although, too, there is often sickness, it is not of that regular morning recurrence that is so often the case in pregnancy. Chlorosis sometimes simulates phthisis and often falls into it; but the cough and the regular hectic are wanting where the malady is merely chlorotic.

Prognosis.—Should there be not much verging towards actual consumption, we may generally pronounce of chlorosis that it is remediable, provided the medicinal plans are judiciously instituted and pursued.

Treatment.—'Give steel,' say the older practitioners. 'Give purgatives,' says Dr. Hamilton. Both are highly useful; but, for the most part, this combination is demanded. The stomach is sometimes too irritable for steel without a good deal of address in the management of it. An emetic may in these cases be premised; indeed, emetic operation is not seldom salutary beyond the mere circumstance of discharging the stomach contents. From the sympathy which this organ maintains with the uterus, it will often be found that the excitation of vomiting is desirable in some inactive conditions of the uterine system, as in the case now before us. For a useful combination of iron, with a purgative, see under *Dyspepsia* (the ferr. amm. with rhubarb). The mistura ferri comp. of the pharmacopœia will be found a good formula in most cases of chlorosis, when the stomach can bear it. The tincture of muriated iron is also useful in doses of fifteen or twenty minims. When fluor albus is an accompaniment, the same dose of the tincture of cantharides may be exhibited. Change of air, exercise, especially on horseback, and mental excitation, ought all, when it can be so managed, to constitute ingredients in the curative process of chlorosis. Marriage is one of Dr. Darwin's prescriptions; and this would be more likely, provided affection was insured and circumstances favorable, than any simple article, or any combination of articles, in the whole materia medica.

Order 3. SPASMODIC AFFECTIONS. Spasmi.

395. *Tetanus. Symptoms.*—It is not often, in this country, that tetanus is met with to that malignant and frightful degree that it manifests in tropical climates. The first symptoms, we are told by authors who describe the malady from having been eye-witnesses to it, are a stiffness in the back of the neck, and a difficulty of swallowing; then a pain attacks the breast, which shoots through to the back and shoulders,—the jaws become locked, and the head is forced violently either forward or backward. Much convulsive movement also takes place in the abdominal muscles; the countenance becomes distorted; the tongue is thrust out of the mouth, and these symptoms, with others marking general perturbation, remit and recur for a longer or shorter time, till 'at length one universal spasm rushes upon the patient, and carries him off in its frightful embrace.'

Causes.—Mere heat, or sudden changes from the extremes of heat to cold, and vice versa, will sometimes of themselves be equal to the

production of tetanus; but for the most part these are mere circumstances of predisposition, and the excitant is some local injury,—more especially that of wounds in tendinous structure. The proximate cause has been recently considered a high state of inflammation in some portion, more particularly the upper portion, of the spinal cord. Others have considered the spinal affections, which are discoverable upon dissection at times, to be rather the effect of that violent impulse which is made upon these parts, and which thus brings the vessels of the theca into an inflammatory condition, than that the inflammation itself is primary and essential (see the introductory remarks to the present order).

Prognosis.—Highly unfavorable for the most part. If it occur merely from the heat of the climate, or general derangement, it may terminate favorably; but, when it is the consequence of lacerated tendinous wounds, it is seldom that life does not succumb under the virulence of the malady.

Treatment.—Opium, in exceedingly large quantities, seems to have been the only remedy hitherto discovered at all efficacious in meeting and conquering the terrific force of this frightful advent. A whole ounce of laudanum has been given in twenty-four hours, and indeed there need scarcely be any limit to its administration, as the convulsive affection seems in a manner to swallow it up, and prevent any of the common effects of the drug upon the frame. When lacerated wounds have produced the tetanus, these should be freely divided and laid open; and the wounds may be dressed with matters with which tincture of opium should be mixed; it has been said that dossils of lint, well imbued with laudanum, and put into wounds, will prove preventive of tetanus. Should worms or stomach derangements have ingendered the disorder, pretty considerable doses of the ol. terebinthinæ might be administered with advantage, and it will of course be at all times requisite to take cognizance of the condition of the stomach and bowels; but after all the round of all the known medicinals that, from analogy, might promise to be of some avail, we believe that no reliance is to be placed on any excepting very large doses of opium, continued till the abatement of the spasms.

396. *St. Vitus's dance.* Chorea.—Dr. Cullen's definition is so accurate that nothing need be added in the way of history.

Causes.—The predisposition to chorea seems to be constituted by a mobility of nerve. The exciting causes are irritations in the stomach and bowels, teething, mental affections, and imitation of others.

Distinctions.—Chorea has been said to bear about the same relation to genuine epilepsy that palsy of one side does to complete apoplexy,—and there is something in the analogy. There is, however, this essential and important difference between the two maladies of epilepsy and St. Vitus's dance, that the latter, however violent, is for the most part but temporary, and comparatively with epilepsy very seldom indeed fatal. Chorea, too, seems more influenced by physical remedies than epilepsy; and we have been as satisfied with the actual efficacy of medical management in this complaint as in almost any that could be named, which are in some measure of a chronic character.

Prognosis.—Seldom dangerous, unless the violent agitation fastens upon some vital part, and produces organic disease, such as hydrocephalus. We have never seen but one death from chorea, and then the disorder became hydrocephalic.

Treatment.—Purgatives and tonics are to be administered, one of the best of which is the nitrate of silver; but it is often found necessary to alternate this with the sulphate or oxide of zinc: cold bathing; sudden impression on the mind; this has occasionally both caused and cured chorea.

Epilepsy. Epilepsia.

Symptoms.—Epilepsy is derived from a Greek verb, επιλαμβανω, which signifies to seize upon, and the suddenness with which its attacks are for the most part made is the particular feature of the disorder from which its name is taken. In stating the more prominent symptoms of epilepsy it is perhaps scarcely necessary to observe, that the same variation of circumstances takes place in this as in every other malady that has a distinctive denomination, and that no one account will apply accurately to different epileptics, or can be considered in any other light than as a collective aggregate of the most ordinary occurrences.

The sudden fall of the patient to the ground is considered as the most essential characteristic of an epileptic fit, so much so indeed that the paroxysms of epilepsy have received the vulgar appellation of falling fits; frequently at the moment of the attack a shrill cry is uttered, and the limbs are soon agitated with violent convulsions; sometimes, in connexion with these general agitations, a fixed permanent spasm takes place in one or more of the muscles, and an epileptic is often observed to retain a firm grasp of any thing that he may have had in his hand immediately before the accession of the fit. The countenance exhibits for the most part a terrifying spectacle, from the violent contortions of the muscles of the face; the eyes become prominent and are fixed; sometimes, however, they are so distorted that scarcely any of the colored part of these organs is discernible; the hair often stands on end as in fright; in the great majority of instances saliva issues from the mouth as foam; and this is not seldom mixed with blood in consequence of the vessels of the tongue being wounded by the convulsive action of the jaws: the saliva that issues is at times extremely fetid, as is likewise the case with other excretions. In some instances the urine and semen are discharged involuntarily, and the former is thrown out, as with a jet, to a considerable distance. The contents of the bladder have been observed, it is said, in children, to form a jet of three feet.

Epileptic attacks are very often made without the intervention of any preparatory signs, or warnings of its approach; at other times the disorder is ushered in by antecedent symptoms, similar frequently to those which precede a paroxysm of apoplexy, such as pain in the head,

vertigo, obscure perception of surrounding objects, stammering in the speech, coldness of the extremities, nausea, and other signs of nervous derangement. One particular phenomenon sometimes precedes a confirmed fit of epilepsy, but of which we perhaps read more in authors than observe in practice, notwithstanding that by some it has been regarded as a sine quâ non in epilepsy, it is a sensation of a peculiar irritation commencing in some distant part of one of the extremities, and perceptibly directing its course towards the brain, before the general shock is effected. This feeling has been named the epileptic aura.

The length of time which a paroxysm of epilepsy lasts varies exceedingly; the average period has been stated to be from fifteen to twenty minutes; the return to the natural state is also made at very different times in different individuals, and is likewise very different in the fits of the same individual. Scarcely a vestige is often left of disorder when the patient shall have recovered from the violence of the fit, while in other cases a languor and general indisposition will remain for hours and even for days. The intervals likewise between the accessions is exceedingly various. Epileptic fits fully marked have been known to recur several times in the course of the same day; at other times weeks, months, or even years, shall elapse previously to the repetition of the disorder.

The lunar periods have been thought by some authors, and are generally conceived by the vulgar, to regulate the return of paroxysms; others state that they have never been able to trace with any certainty this supposed connexion, although they have watched the disorder with particular reference to this point.

By the protraction of the complaint, or very frequent recurrence of the paroxysms, the memory and intellectual faculties in general become much weakened in the majority of cases; and, when actual insanity supervenes upon a long continued epilepsy, the distemper is considered of so malignant and confirmed a nature that the public receptacles for the cure of the insane, close their doors against the admission of this kind of lunatics.

The disease in the severe form above described most commonly happens at the season of youth. The epilepsy of infants is for the most part of a much milder nature and remediable character; indeed the fits of childhood which by common consent are denominated epileptic, have often no determinate form or origin.

Causes.—Let the student remark the several causes cited in the nosology. Predisposition to epilepsy is often hereditary; the exciting causes are all those which derange the mobility of the nervous system; such as vehement emotions, affections, or passions. Terror is a common cause of epilepsy. The physical causes are those that exist in the brain, such as slow inflammation, or congestion; tumors, polypi; spiculæ of bone: abscess; hydrocephalus; or those that primarily affect other portions of the frame, such as irritations in the alimentary or intestinal canal, more especially worms; suppressed evacuations, as of the menstrual discharge; repelled eruptions of the surface; difficult and painful dentition. But to the question what is the proximate cause of epilepsy? it is difficult to give a satisfactory answer. If it be said that it is an overladen or overactive condition of the blood-vessels of the organ, it might be objected, why does not such plethora or irritation always occasion this particular form of the disease? Again, the phenomena connected with the sympathetic production of the complaint, as above alluded to, and the habitual occurrence of it when it is permanently fixed as a constitutional disorder, are against the notion of either plethora or vascular irritation being absolutely necessary to the production of epilepsy—though these conditions of the brain do unquestionably occur at times simultaneously with the occurrence of the fit.

Distinction.—The distinguishing features of epilepsy are convulsion of the limbs, in connexion with sopor, and the foaming at the mouth. See *Apoplexy*.

Prognosis.—When the malady depends upon cerebral conformation, or permanent disorder in the brain, it is incurable. It will sometimes leave the person that has been attacked before the age of puberty, at the time when the sexual characteristics appear. When the disorder is sympathetic, it for the most part yields with the yielding of the primary complaint. It often terminates in apoplexy, or madness, or idiotism. An intermittent fever or chronic eruption on the skin has been known to cure an epilepsy.

Treatment.—If it be symptomatic of worms, vermifuges are of course its remedies. If the fits are connected with manifestations of cerebral fulness of blood, bleeding must be enjoined; if, on the contrary, an asthenic condition of the system, and want of cerebral excitement, are the concomitants, stimulants, especially the carbonate of ammonia, are loudly called for; and the practitioner should ever bear in mind the active and passive states in which these convulsive disorders show themselves. The following enema has been recommended:

℞ Tinct. assafœtid. f. ℥ß.
Tinct. opii f. ʒi.
Aquæ f. ℥viij.
Fiat enema.

Take of tincture of assafœtida a fluid half ounce, tincture of opium a fluid drachm, water eight fluid ounces. Make an enema.

During the fit care must be taken to loosen every thing about the patient, especially his neckcloth, and buttons of his collar; thrusting a something, as a piece of wood, between the teeth, will prevent the tongue from being wounded, and is said to shorten the time of the fit. Dashing cold water over the face is sometimes proper and useful. It is always right, as in apoplexy, to let the head be rather high. In the permanent treatment, we must endeavour to strengthen the nervous system, when the disorder is the result of mobility, founded on weakness; the most powerful of the tonics, for effecting this purpose, are the oxide and sulphate of zinc, the medicinal preparations of copper, the nitrate of silver, and the vegetable bitters, or the Peruvian

bark. It will be found expedient often to vary and alternate these medicines, and sometimes advantage will be obtained by their combination.

℞ Argenti nitratis gr. i.
Conf. rosæ gr. v.
Fiat pilula: ter in die deglutienda.

Take of nitrate of silver one grain, confection of roses five grains. Make a pill, to be given three times a day.

℞ Zinci sulphatis gr. j.
Pilulæ galbani compositæ gr. ix.
Fiant pilulæ duæ: ter in die sumendæ.

Take of sulphate of zinc (white vitriol) one grain, compound galbanum pill nine grains. Make them into two pills; to be taken three times a day.

℞ Zinci oxydi gr. iv.
Extracti gentianæ ℈ß.
Fiant pilulæ tres: ter in die capiendæ.

Take of oxide of zinc four grains, extract of gentian ten grains. Make three pills; to be taken three times a day.

℞ Cupri ammoniati gr. ij.
Confectionis rosæ gr. v
Fiat pilula: ter in die exhibenda.

Take of ammoniated copper two grains, conserve of roses five grains. Make a pill; to be taken three times a day.

The sulphate of quinine will not be so likely to nauseate the stomach as the requisite quantities of bark in substance.

While administering these medicines, it will be necessary to attend to the alvine and other secretions, and, if any marks of plethora present themselves, these must be met by local, if not by general blood-letting, even at the time that we are persisting in our generally tonic plan of treatment.

It may be doubted whether much good is effected, in epileptic affections, by the class of medicinals that are called antispasmodic, such as castor, assafœtida, musk, ether, and others. The valerian, however, seems not only antispasmodic, but permanently tonic, to the nervous organisation; and, as such, especially applicable to convulsive and other affections, the origin of which is in pure debility of the sentient and motive powers.

℞ Rad. valerianæ incisæ ℥j.
Canellæ alb. cort. contus. ʒij.
Aquæ ferventis Oi.
Macera per horas duas, dein cola.

℞ Hujus colaturæ f. ʒxij.
Tinct. valerian ammon. f. ʒj.
Fiat haustus: ter in die sumendus.

Take of cut valerian root one ounce, canella alba bark bruised two drachms, boiling water one pint.

Digest for two hours, then strain.

Take of the strained liquor twelve fluid drachms, ammoniated tincture of valerian one fluid drachm. Make into a draught; to be taken three times a day.

The purgatives that are employed in epilepsy ought, for the most part, to consist of those which are warm and stimulating; and in case of the disease depending in females, as it sometimes does, upon uterine irregularities, the decoctum aloes compositum will be found especially serviceable. The dose is from a fluid half ounce to an ounce and a half.

Sea and cold bathing are sometimes beneficial. An emetic, or a large dose of opium, as in intermittent fever, just before the recurrence of the fit, is said to prevent or mitigate it; the attack, however, is, for the most part, too sudden to admit of these expedients.

Many are the reputed specifics in epilepsy, such as the viscus quercinus, or misletoe; the gratiola officinalis; the rhus radicans; the cicutaria, &c. But in the present day scepticism, respecting the virtues of these reputed remedies, increases upon us, and we are disposed to think nothing operative but what has either a manifest agency upon the secretions, or a decided influence in giving tone and energy to the nervous system.

The oleum terebinthinæ, as an antiepileptic, perhaps, came to be lauded on account of its virtue as an anthelmintic; and its continued employment, in doses of about thirty minims, twice a day, in peppermint-water, may prove positively beneficial, when the epileptic disorder is connected, in the way of cause, with intestinal irregularities. But of confirmed epilepsy, arising from hereditary conformation, permanent brain disease, or any other inherent and untangible source, if time may be looked to as a cure, medicine certainly cannot.

Change of climate, and habits of life, may occasionally have operated with radical and permanent benefit.

398. *Palpitation.* Palpitatio.—This arises from the same circumstances and causes as syncope, when it is not an organic affection. See *Syncope*.

Asthma.

Symptoms.—An attack of asthma is often preceded by drowsiness, pain in the head, and a feeling of flatulent fulness about the stomach, with a depression of spirits, and sluggish bowel. —At other times, the disorder, attended by the symptoms marked in the definition, seizes upon the patient at once: this is often in the night, after the first sleep; and it recurs nightly for some length of time. The patient has, for a time, a distressing sense of suffocation, occasioning him to rise from a horizontal to an upright posture, which, with the wheezing, and subsequent expectoration, are truly characteristic of this dreadful disorder. The expectoration generally comes on towards the approach of morning.

Causes.—In the hereditarily disposed, asthma will occur from almost any cause which in others create common derangement; exposure to cold or moisture; violent exercise; mental agitation; suppressed evacuation; receding exanthemata, or retrocedent gout; stomach, or hepatic, or bowel, or uterine, or renal irritation, will all, under predisposition, prove excitants of the disorder.

Distinctions.—It is distinguished from pulmonary inflammation, either of an ordinary or specific kind, by the periodical character of its attacks, the patient in the intervals being free

from disease, by the wheezing, and by the peculiar sense of suffocation. It is seldom too that asthma is attended by those pyrexial or febrile accompaniments that are found in truly inflammatory affections of the chest.

Prognosis.—Generally unfavorable, when confirmed; when it takes place in young persons, and is traceable to obvious causes, a recovery may be expected. Its fatal termination is, for the most part, by the induction of other diseases, such as organic affections of the heart, and hydrothorax. Sometimes, indeed, positive inflammation of the lungs will be the consequence of asthma.

Treatment.—In habits of much plethora and high action, blood-letting is required in the paroxysm; in taking away blood, however, we must recollect the spasmodic nature of the disorder, and its tendency to terminate in hydrothorax. Antispasmodics are often freely admissible, and combinations of these with anodynes prove useful. Assafœtida glysters may be thrown up the rectum.

℞ Spiritûs ætheris sulphurici compositi f. ʒj.
Tincturæ opii ♏vj.
Misturæ camphoræ f. ℥iß.
Fiat haustus.

Take of compound spirit of sulphuric ether a fluid drachm, tincture of opium six minims, camphorated mixture a fluid ounce and a half. Make them into a draught.

One of the most powerful agents, as adapted to the circumstance of asthma, is the stramonium.

℞ Extracti stramonii gr. ß.
Confectionis aromaticæ q. s.
Fiat pilula: ter in die sumenda.

Take of extract of stramonium half a grain, aromatic confection enough to form a pill. To be taken three times a day.

The belladonna, and aconitum, and digitalis, and conium, have been administered with the same intention.

Towards the close of the paroxysm, when expectoration is not free, let expectorant remedies be administered.

℞ Misturæ ammoniaci,
Aquæ puræ āā f. ʒvj.
Tinct. scillæ ♏x.
Syrupi tolutani f. ʒj.
Fiat haustus.

Take of ammoniacal mixture and water of each six fluid drachms, tincture of squill ten minims, syrup of tolu one fluid drachm. Make them into a draught.

The application of a blister to the chest is often highly useful. The bowels must be briskly acted on with the warm and aromatic purgatives; and both in the treatment and the prevention of asthma, but more especially in the latter, the state of the stomach, and first passage, must be sedulously attended to. Dr. Bree treats asthma as a stomach disorder; he cautiously confines the diet to easily digested materials, and gives carbonate of steel, soda, &c., to strengthen the fibres of the stomach, correct the acid fermentation, and alter the internal secretions. In this view, also, he recommends small doses of the mineral acids. Warm clothing is always necessary in asthma. Coffee is sometimes found to abate the violence of the disorder. Regular exercise, both of walking and horseback, should be enjoined: an assiduous care should be taken not to check perspiration. Change of air is often desirable; but there is great irregularity, and often inexplicably so, with regard to the appropriate kind of air for asthmatics; some being benefited by a warm, others by a cold atmosphere; some breathing best in a humid, some in a dry situation; some courting the vivifying air of an open country, others loving rather the smoky atmosphere of a large city. Issues are occasionally of service to old asthmas; and some are in the practice of giving an emetic just before the expected accession of the fit.

399. *Difficulty of Breathing.* Dyspnœa.—Dyspnœa is rather a symptom of other diseases than in itself a malady of a specific kind. Asthmatic and other impediments to free respiration are often obscure in their rationale; sometimes there seems to be a sort of spasmodic stricture in the bronchial cells, without inflammatory action on the one hand, or effusion of lymph, or mucus, or matter, on the other hand; and then the true spasmodic asthma is present; at other times the secretion or effusion is temporary, and the pituitous asthma is formed; then again it is permanent, and permanent difficulty of breathing, or dyspnœa, is produced. This dyspnœa may, indeed, be occasioned by other causes of a more extensive nature, such as adeps pressing upon the bronchiæ, or mal-conformation of the thoracic cavity; in the one case the remedy is obvious, in the other it must be obvious there is no remedy.

400. *Whooping cough.* Pertussis.

Symptoms.—Whooping-cough often exists with very little more than ordinary catarrhal symptoms for two or three weeks; the breathing, however, will generally be found to be more difficult and obstructed than in common cough; at length the whooping sound is heard, which is occasioned by the air rushing through the glottis with unusual force and rapidity, to make up, as it were, for the convulsive and frequently recurring expirations. After the fit or fits are over, a considerable quantity of mucus is brought up, by which the little patient is relieved from his distressing and suffocative sensations, and he returns to his play as if nothing had happened or was again to happen. Vomiting frequently terminates a violent paroxysm, and then, for the most part, the subject of the disorder expresses a great desire for food. But the peculiarity of the complaint is certainly this, that in the intervals of the fits there are no relics of the disorder, until, by the protraction of the malady, the individual becomes worn down, or bronchial inflammation, of a permanent kind, has taken place of the mere spasm by which, in the first instance, the distemper seems to be constituted.

Causes.—Specific contagion. Whether it may arise spontaneously, or whether, under epidemic peculiarities of the atmosphere, it may be made to supervene upon common catarrh, is a doubtful

and disputed point. Its proximate cause seems, as just intimated, to consist of spasm in the first instance, and congestion and inflammation in the course of time.

Distinctions.—The distinguishing peculiarities of the affection are the whooping noise, the complete cessation of the distressing feelings in the intervals of the fits, and the paroxysms ending in vomiting.

Prognosis.—When the disorder occurs after the child has got through dentition, when the strength seems but little impaired, and the tendency to pulmonary inflammation does not manifest itself, expectations of thorough recovery are well founded. The unfavorable concomitants are, early infancy, much appearance of pulmonary congestion; and the occurrence of convulsions; indeed, the bias of the disorder is often towards head affection in young children.

Treatment.—If inflammatory or congestive appearances manifest themselves, put leeches upon the chest or head. Give emetics of ipecacuan and antimony combined; let the bowels be kept free; meet the pyrexial irritation by saline diaphoretics, and the supersaturated liquor ammoniæ acetatis (that is, supersaturated with ammonia), should there be much appearance of sinking. Give hyoscyamus, and conium, and digitalis, and prussic acid, in conjunction or separately, when the cough seems purely spasmodic; occasionally change these from one to the other. When there is much difficulty of expectoration, add a little of the wine of ipecacuan, and the oxymel of squills, to the above antispasmodics. Correct the stomach acidities by carbonated soda or potass. A popular remedy for whooping-cough consists of salt of tartar and cochineal, and it is said to be very efficacious. Apply blisters to the chest, or the tartarite of antimony ointment, with opium. Rub the chest and neck with diluted tincture of cantharides; give small doses of this internally; and when the violence of the disorder is abated, debility only remaining, give tonics, such as Peruvian or Cascarilla bark, or small doses of the liquor arsenicalis. Above all, change of air, which is magically operative in whooping cough, in cases of protracted convalescence, and indeed, it sometimes will prove abundantly beneficial, even during the height and violence of the complaint.

401. *Water-brash.* Pyrosis.

Symptoms.—The fits of water-brash generally recur in the morning: there is sometimes an accompanying sensation, as if the stomach were drawn down towards the back. For the most part, as stated in the definition, the discharge is watery and thin, but it is sometimes glutinous and ropy. The pain is generally increased by an erect position of the body, which occasions the subject of the disorder to stoop forward.

Causes.—It appears to be a peculiar spasm of the stomach, affecting the secretions of the organ; it is sometimes brought on by poverty of diet, and mental anxiety. The lower classes of people, who live much upon food of a farinaceous kind, are very obnoxious to it. It often continues by habit for a long time.

Treatment.—Antispasmodics and absorbents; a plaster composed of equal parts of the emplastrum opii and emplastrum cumini to the epigastrium; the subnitrate of bismuth.

℞ Bismuthi subnitratis gr. vj.
Pulveris rhei, gr. iij.
Tragacanthæ, ℈ß.

Fiat pulvis; bis terve in die sumendus.

Take of the white oxide of bismuth six grains, of powdered rhubarb three grains, of gum tragacanth ten grains. Make them into a powder, to be taken three times a day.

The nux vomica may be tried in doses of five or six grains. Eggs boiled hard, and eaten pretty freely, have put a stop to obstinate pyrosis. The smoking or chewing of tobacco will likewise occasionally subdue it.

402. *Colic.* Colica.—Abdominal pain with a sense of twisting, especially about the navel; vomiting; constipated bowel. It is produced, first by spasm, second by the poison of lead, in which case we have what is called the painter's colic, marked by a gradual accession of the severer symptoms, with pains in the arms and back, the arms eventually become paralysed; third, by protracted costiveness; fourth, by acrid ingesta; fifth, by retention of the meconium in infants; sixth, by stricture in some part of the intestinal canal, occasioning windy collections and eructations; and seventh, by calculous concretions in the bowels.

Distinctions.—From enteritis, by the absence of pyrexia, by pressure in inflammation increasing, while in colicky spasm it sometimes diminishes pain, and by the irregular contraction in the abdominal muscles which has place in colic.

Prognosis.—Favorable when the pain remits or changes its situation; when there is a discharge of wind and fæces, followed by an abatement of symptoms. Unfavorable symptoms are violent fixed pain; obstinate costiveness; sudden cessation of the pain followed by more frequent hiccough, great watchfulness, delirium, syncope, cold sweats, weak tremulous pulse, the pulse becoming hard, and the pain, before relieved, now becoming increased by pressure; in fact, all the symptoms indicating the supervention of inflammation.

Treatment.—To be directed, of course, to its exciting cause. Sometimes it is necessary to have immediate recourse to powerful antispasmodics, whatever shall have been the source of the disorder. Warm fomentations are always admissible, and for the most part conspicuously serviceable; the warm bath; and when we wish for evacuations, and fail in producing them, dashing cold water upon the legs and abdomen, or causing the patient to stand with his naked feet on cold marble, will sometimes relax the spasm which thus obstinately retains the fæces. Give the croton oil, in doses of two or three drops, when common purgatives fail; rub the abdomen all over with castor oil; give large doses of castor oil internally, when the stomach will bear it. This last is especially applicable in the colica pictonum, which requires also small doses of calomel and opium combined, given for some time.

Warm bathing is exceedingly useful in colica pictonum; and in its chronic state, when little besides the paralysis of the arms remains, the use of the Bath waters proves of unequivocal efficacy.

In all cases of colic we should carefully watch the coming on of inflammatory symptoms; and it is partly because inflammation is so easily induced that we must, while using our antispasmodics freely, take especial care that we do not lock up fæcal, or calculous, or any other matter in the intestinal passages. The opiate confection is one of the best forms of administering opium in colicky pains; it is not so constringing as other preparations of this medicine, and its constipating tendency may be guarded against by tincture of rhubarb. Its dose may be a scruple.

The opiate confection deserves to be in more frequent use than it is in the general practice of medicine.

We have been principally indebted to Dr. Uwins and Dr. Hooper for the three or four last sections, having done very little more than add a few remarks on their histories and descriptions, and given a translation of their recipes. The two following sections on colica pictonum and worms we extract unaltered from Dr. Hooper's Vade Mecum.

403. *Of the colica pictonum.*—The colic induced by lead, is more obstinate, and longer protracted, than the same disease brought on from common causes; and frequently terminates in paralysis of the wrists and upper extremities.

Treatment.—Oleum ricini, often repeated, is most effectual in procuring stools, and, with fomentations and warm bath, generally removes the disorder in a few days; afterwards mercury united with opium, to excite slight salivation; alum; electricity; chalybeate and sulphureous waters; sinapis.

℞ Hydrargyri submuriatis gr. ¼.
Extracti opii gr. ß.
Confectionis rosæ q. s.
Fiat pilula; ter in die sumenda.

Take of calomel a quarter of a grain, opium half a grain, conserve of roses enough to form a pill, to be taken three times a day.

℞ Hydrargyri submuriatis gr. ¼.
Sulphureti antimonii præcipitati gr. ½.
Confectionis opii gr. v.
Fiat pilula; ter in die capienda.

Take of calomel a quarter of a grain, precipitate sulphuret of antimony half a grain, opiate confection five grains. Make them into a pill, to be taken three times a day.

℞ Aluminis purificati ℈ß.
Infusi rosæ f. ʒxij.
Syrupi ejusdem f. ʒj.
Fiat haustus; ter in die sumendus.

Take of purified alum ten grains, infusion of roses twelve fluid drachms, syrup of the same one fluid drachm. Make them into a draught, to be taken three times a day.

Colica pictonum is often productive of inflammation of the bowels and peritonæum, when the warm bath, general and local blood-letting, must be had recourse to.

WORMS.—The human primæ viæ are infested by five kinds of worms.

1. Ascaris vermicularis: the small white thread or maw-worm.

2. Ascaris lumbricoides: the lumbricus teres, or long round worm.

3. Trichuris: the long hair-tailed thread-worm.

4. Tænia osculis marginalibus: the solium, or tape-worm.

5. Tænia osculis superficialibus: the broad tape-worm.

The ascarides have usually their seat in the rectum; the lumbrici occupy the small intestines, and sometimes the stomach; the trichurides the cæcum; the tæniæ the whole tract of the intestines, more especially the ileum.

Worms mostly produce symptoms of colic, and very frequently other symptoms, as variable appetite; fœtid breath; picking of the nose; hardness and fulness of the belly; sensation of heat and itching in the anus; preternaturally red tongue, or alternately clean and covered with a white slimy mucus; grinding of the teeth during sleep; short dry cough; frequent slimy stools; emaciation; slow fever, with an evening exacerbation; irregular pulse; sometimes convulsion-fits.

Worms appear more frequently in those of a relaxed habit; those whose bowels contain a preternatural quantity of mucus or slimy matter; in those who live on vegetable food; in the dyspeptic; the eating of unripe fruit is a frequent cause of their production.

They are evolved from ovula that exist in the human body, and in no other situation. For further information on this subject, consult An Attempt to an Arrangement of human intestinal Worms, published by the author in the fifth volume of the Memoirs of the London Medical Society.

Of colica verminosa.—1. The most esteemed remedies against ascarides and trichurides are purgatives of the submuriate of mercury, scammony, aloes, rhubarb, spigelia, cowage, tin; also assafœtida, lime-water, tobacco.

℞ Hydrargyri submuriatis gr. ij—vj.
Pulveris rhabarbari ℈j.
Fiat pulvis ex melle sumendus.

Take of calomel from two to six grains, powder of rhubarb twenty grains. Make into a powder to be taken with honey.

℞ Scammoniæ gr. iij.
Hydrargyri submuriatis gr. ij.
Sacchari purificati gr. vj.
Fiat pulvis ex quovis vehiculo crasso sumendus.

Take of scammony three grains, calomel two grains, purified sugar six grains. Make them into a powder to be taken in any thick vehicle.

℞ Extracti aloes spicatæ,
Extracti tanacæti, āā ʒß.
Olei rutæ ♏ xij.
Fiant pilulæ xij. quarum sumat æger duas nocte maneque.

Take of extract of aloes and of tansey of each half a drachm, oil of rue twelve minims. Make the mass into twelve pills, of which two are to be taken night and morning.

℞ Radicis spigeliæ ʒvj.
Aquæ ferventis O j.
Macera per horas duas.

℞ Hujus infusionis f. ℥xij.
Tincturæ cardamomi f. ʒj.
Syrupi zingiberis f. ʒj.
Fiat haustus nocte maneque capiendus.

Take of Indian pink six drachms, boiling water a pint. Let them stand to infuse for two hours. Then take of this infusion twelve fluid drachms, of tincture of cardamoms and syrup of ginger of each one fluid drachm. Make them into a draught to be taken night and morning.

The dolichos pruriens, or cowage, is best prepared at the late Mr. Chamberlaine's, of Aylesbury Street, Clerkenwell, and sold with proper directions.

℞ Liquoris calcis O j.
Fiat enema omni nocte injiciendum.

Take of lime water a pint. Make an enema to be administered every night.

℞ Misturæ assafœtidæ f. ℥iij.
Lactis vaccini f. ℥v.
Fiat enema tertia quaque vesperi adhibendum.

Take of assafœtida mixture three fluid ounces, cow's milk five fluid ounces. Make an enema to be administered every third evening.

℞ Foliorum tabaci ʒß.
Aquæ ferventis f. ℥x.
Macera, et liquorem frigefactum cola pro enemate.

Take of tobacco leaves half a drachm, boiling water ten fluid drachms. Digest, and when the liquor is cold let it be injected into the rectum.

℞ Limaturæ stanni f. ℥j.
Electuarii e senna f. ℥ij.
Syrupi zingiberis q. s.
Fiat electuarium molle, de quo sumatur cochleare unum minimum quovis mane.

Take of filings of tin an ounce, lenitive electuary three ounces, syrup of ginger as much as necessary to make a soft electuary, of which a tea spoonful may be taken every morning.

℞ Camphoræ ʒj.
Olei olivæ f. ℥ij.
Solve pro enemate urgente ani prurigine adhibendum.

Take of camphor a drachm, olive oil two fluid ounces. Rub them together so as to dissolve the camphor, and let the solution be employed as an enema in case of violent itching at the anus.

A decoction of the geoffræa inermis, or cabbage-bark, is a remedy much used, according to Dr. Wright, in the West Indies.

2. Against the tæniæ most of the drastic purges before prescribed have been resorted to. Madame Noufer's remedy is occasionally used with success. She directs as follows:—

The day before the patient is to take the remedy he is to avoid all aliment after dinner, till about seven or eight o'clock at night, when he is to take a soup made thus:—

Take a pint and a half of water, two or three ounces of good fresh butter, and two ounces of bread cut in slices; add to this salt enough to season it, and then boil it over the fire to the consistence of panada.

About a quarter of an hour after this, she gives him a biscuit and a glass of white wine, either pure or mixed with water; she even gives water alone to those who have not been accustomed to wine. If the patient has not been to stool that day, or is naturally costive (which is not usual, however, with patients in this way), Madame Noufer directs the use of a clyster.

Take a handful of the leaves of mallows, and boil them in a sufficient quantity of water, mixing with it a little salt, and, when strained off, add two ounces of oil.

Early the next morning, about eight or nine hours after the supper, the patient takes the following specific:—

Take two or three drachms of the male fern, gathered in autumn, and reduced to a very fine powder, in four or six ounces of water distilled from fern, or the flowers of the lime-tree.

It will be right for the patient to drink two or three times of the same water, rinsing his glass with it, so that none of the powder may remain either in the glass or his mouth in bed; and, to avoid the nausea which this medicine sometimes occasions, he should chew lemon, or something else that is agreeable to him, or he may wash his mouth with whatever he likes, but he must be careful not to swallow any thing. He may likewise smell to vinegar, to check the sickness; but if, notwithstanding all his efforts, the nausea continues, and he is obliged to throw up the specific, it will be right for him to take a fresh dose of it as soon as the sickness is gone off, and then he should try to go to sleep. About two hours after this he must get up, and take the following:—

Take of the panacea of mercury fourteen times sublimed, and select resin of scammony, each ten grains, of fresh and good gamboge six or seven grains. Reduce each of these substances separately into a powder, and mix them with some conserve into a bolus.

This is to be taken at one or two different times, washing it down with one or two dishes of weak green tea, the patient walking afterwards about his chamber.

When the bolus begins to operate, the patient is desired to take a dish of the same tea occasionally, until the worm is expelled: then, and not before, Madame Noufer gives him broth or soup, and he is directed to dine as is usual after taking physic. After dinner he may either lie down or walk out, taking care to conduct himself discreetly, to eat little supper, and to avoid every thing that is not of easy digestion.

The panacea of mercury is the submuriate; and the male fern is the polypodium filix mas of Linnæus, and aspidium filix mas of Smith.

4. Turpentine has been given in some cases with success. In the year 1795 a letter was put into the hands of the author, from a medical gentleman in the East Indies, which contained an account of a large dose of the oil of turpentine having been swallowed by mistake, and which brought away several worms. In consequence of this, the oleum terebinthinæ was administered as an anthelmintic in the dose of from one drachm to an ounce to several patients with tæniæ; the result was equally uncertain with other purgatives. Of late its use has become more general. The best way to give it is

mingled with syrup, and to direct the patient to take some gruel, arrow-root, or sago, after it. It produces a slight vertigo, and a sense of warmth and heat in the œsophagus and stomach, like to that produced by a glass of brandy; but these are very transient. Three or four evacuations are mostly produced by half an ounce.

405. *Cholera.* Vomiting and purging.

Symptoms.—The characteristic symptom of this sometimes very severe malady is the combination of vomiting and purging of bilious matter, and when the disorder is violent there is extreme sinking and painful feeling about the epigastrium, with spasms of the legs as mentioned in the definition; very great exhaustion of powers; hurried fluttering pulse, heat, thirst, and oppressed respiration. When the attacks are made with malignant violence, a fatal termination is sometimes the consequence, and that within twenty-four hours from the first occurrence of the sickness. In this case death is preceded by cold clammy sweats, very great irregularity in the pulse, and very violent cramps in the legs; hiccough, too, for the most part, precedes death.

Causes.—This is a disorder of the autumnal season, and seems to be occasioned by an acrimony of the bile produced by the combination of heat and moisture, connected in its manifestation with the cold, which, in the autumnal season, often quickly succeeds to heat, and tends to increase the disposition to the internal direction of the secretions, by obstructing the vessels on the surface of the body, or interrupting the irregularity of cutaneous discharge. The autumnal fruits have been supposed to be one main cause of the disorder appearing in the autumnal season; and, as far as these are difficult of digestion (plumbs and cherries in particular), there may be some justice in the allegation; but we very often find persons who never taste fruit the subjects of these violent bilious attacks; and it should seem, as above intimated, that the malady is rather referrible to sudden changes in atmospheric temperature, to cold and damp nights succeeding to hot days, and probably to some sort of specific influence that this combination of heat, and cold, and moisture, may have upon the biliary secretion, in increasing its quantity and imparting to it acrimony. In the tropical climates cholera shows itself with a force and malignity of which we in this latitude know nothing but by history; and this circumstance is in favor of the principle we now intimate as the most probable one to which its source may be attributed.

Distinctions.—Diarrhœa often occurs with some violence from the mere acrimony and overflow of the bile, but if the discharges are not accompanied by vomiting the disorder is without the essential of cholera morbus. In colic, too, and other enteric affections, there is often on the other hand considerable vomiting, but then the bowels are costive, and the disease therefore is different from cholera.

Prognosis.—When the oppression and exhaustion are extreme we may anticipate an unfavorable termination. In this country, however, the disorder does not, as above stated, in the general way put on so much malignity of character and aspect, and if the interference of art be prompt and judicious, the malady usually terminates speedily and favorably.

Treatment.—We are for the most part told by authors that a great deal of diluent drink should be thrown into the stomach, such as barley water, thin water gruel, and linseed tea, in order to lessen the acrimony of the bile, or sheath the coats of the stomach against its morbid influence. We are a little doubtful, however, with regard to the theory upon which the stomach is thus ordered to be drenched, and in the general way should avoid the practice. Opium should be speedily given, and, if the stomach is too irritable to bear it, enemas may be administered of starch in which there is a considerable dose of tincture of opium. The cholera which we meet with in this country will be usually controlled by a grain of opium and a grain of calomel given in the form of a pill; and, whether it is on account of the specific influence which the calomel as mercury has upon the liver, or from any other cause, certain it is that its combination with opium will often occasion the latter to stay on the stomach and assist in subduing the violence of the vomiting. Five grains of blue pill, with a grain, or half a grain, of opium, may be employed with the same intention and effect. A small draught, in which from ten grains to a scruple of opiate confection is rubbed down with some mint water, will sometimes be received by the stomach in spite of its irritability. Warmth applied externally, in the way of fomentation, to the epigastrium and abdomen generally, will often prove very serviceable, and sometimes the discharge of bile will be checked by the application of a blister either to the epigastrium or the back. The external application of a liniment, in which tincture of opium is mixed, as in the following formula, may also be advisable in these and some other cases of irritable stomach; indeed, external applications are not perhaps used and appreciated to the extent they deserve.

℞ Linim. camphoræ comp. f. ℥iss.
Tinc. opii f. ʒij.

Fiat linim. in ventriculi regionem fricatione sæpe applicandum parvâ quantitate.

Take of compound camphor liniment a fluid ounce and a half, tincture of opium two fluid drachms. Make them into a liniment; a small quantity of which is to be rubbed on the stomach frequently.

When the extreme irritability of the stomach has somewhat abated, and from the first in ordinary cases, tincture of rhubarb may be administered in small quantities. The following formula will be found, in many cases of sickness which should hardly amount to the violence of cholera, to be exceedingly beneficial; indeed, we have passed season after season, and have had public establishments to take care of, without the necessity of much more in the way of an immediate medicinal for ventricular complaints of the kind now referred to.

℞ Tinct. rhei f. ʒiij.
Confect. opii gr. xv.
Aquæ menthæ sat. f. ℥iss.

Fiat haustus.

Take of tincture of rhubarb three fluid drachms, opiate confection fifteen grains, simple mint water a fluid ounce and a half. Make them into a draught.

In the extreme exhaustion of the violent cases of cholera fifteen grains of opiate confection mixed with the same quantity of aromatic confection, and eight or ten grains of subcarbonate of ammonia, rubbed down into a draught with water, will often prove signally beneficial.

We have just said that the cholera of Britain is a mild disease, in the majority of cases, compared with that which is met with in the Indies. Of the frightful force with which attacks of bilious disorder are made in the east, and of the rigorous measures required to meet and subdue them, an opinion may be formed by the following masterly account taken from the Study of Medicine by Dr. Mason Good.

The rapid or sudden fatality of the disease (the Indian cholera), in its severest onsets, is very singular. Even Sonnerat affirms, 'that the patient was frequently carried off in twenty-four hours.' But, in the later epidemy of 1817 and 1818, this term was wonderfully abridged. 'In the second, and very fatal visitation,' says Mr. Orton, 'of the epidemic experienced by Brigadier-general Pritzler's force, I am informed that vomiting, purging, and spasms were very frequently, in a great measure if not entirely absent: all the powers of the system failing at once, and death commonly ensuing in three or four hours from the attack.' Several instances were heard of at Hoogly, and other places, of natives being struck with the disease whilst walking in the open air; and who, having fallen down, retched a little, complained of vertigo, deafness, and blindness, and expired in a few minutes. Mr. Gordon gives a history of many cases of this kind. At Bellary, a tailor was attacked with what was supposed to be cholera, and instantly expired, with his work in his hands, and in the very attitude in which he was sitting.

The dissections in this presidency seem to have shown even a more extensive range of visceral effusion, congestion, and extravasation than those in Bengal. Not a single thoracic or abdominal organ was to be traced unmarked by vascular rupture, or turgescence of black-blood, or unstampt with some other morbid appearance; the stomach and liver, however, were chiefly affected, and the urinary bladder was always shrivelled. The blood, when drawn from the arm, was found to coagulate very loosely, and sometimes not at all: and the arterial and venous blood were of a like purple hue.

Of the dreadful spread and havoc of this cruel Asiatic scourge, we may form some idea, from the report to the Medical Board at Bombay, by George Ogilvy, esq., secretary. The population in this district alone is calculated at from 200,000 to 220,000; the total number of ascertained cases amounted to 15,945; giving a proportion of seven and a half per cent. Of these cases 1294 sick had been without receiving medicine, or medical aid; and there is reason to believe that of these every individual perished. Mr. Ogilvy, indeed, expressly asserts that it was not ascertained that any case had recovered in which medicine had not been administered: while it is gratifying to learn, on the other hand, that, among those who had received the advantages of the judicious and active plan concurrently pursued, the proportion of deaths was reduced to 6·6 per cent., an alarming mortality still, but a marvellous improvement upon the natural course of the disease. In other parts of India, indeed, the deaths, under the same plan of treatment, seem to have been still fewer: for Dr. Burrell, surgeon to the sixty-fifth regiment at Seroor, out of sixty cases, makes a return of only four deaths; and Mr. Craw, on the same station, asserts, that, on an early application for relief, the disease in his opinion 'is not fatal in more than one in 100 cases.'

The curative plan, pursued with so much success, consisted in bleeding, according to the strength of the patient; calomel in free doses of from fifteen to twenty grains in a dose; with one or two grains of opium, repeated, if necessary, every four, three, and in some cases every two hours, till the urgency of the symptoms abated: to these were added a liberal use of the most diffusible stimuli, as the spirit of nitric ether, ammonia, camphor, hot arrack-and-water, mixed with spices and sugar, camphor-mixture, essential oil of peppermint, the hot-bath, stimulant embrocations; and sometimes the antimonial powder in doses of five grains given in conjunction with the calomel.

We are informed of a fortunate blunder in one instance, capable of being laid hold of and applied with great practical advantage. 'By mistake, twenty grains of calomel and sixty minims of laudanum were given at an interval of less than half an hour. The patient was inclined to sleep; nothing more was done; and in two hours and a half he was as well as ever he was in his life.'

Many of the cases proved successful without the use of the lancet: but, from a return of Dr. Burrell, the hazard of omitting it, whenever blood could be made to flow, seems rather unjustifiable: for according to this return out of 100 patients eighty-eight were bled, and twelve not; of the former, two died, being one to forty-four; of the latter, eight, being two-thirds or nearly thirty to forty-four. It is altogether idle therefore to depend upon stimulants alone, and to boast of their power to subdue the disease without active evacuants in the beginning of the curative process, as Hufeland and other writers on the continent appear to have done, without a sufficient knowledge of the real nature of the disease; if, indeed, it be this species which they have undertaken to describe, of which there is great reason to doubt.

Of the remote cause of this extraordinary malady we know nothing. That it is an epidemy, and of a most malignant character, is unquestionable; but whether dependent upon an intemperament of the atmosphere, or upon specific contagion, is by no means ascertained. The first was the most obvious mode of accounting for it, and that which was earliest adopted; but by many practitioners it has been rejected, for the following reasons. The disease, instead of spreading from a centre to a circumference, or following the

course of the wind, or of the sun, or obeying any other meteorological power, marched by a chain of posts, often in direct opposition to all kinds of atmospherical influence, and in the immediate track of human intercourse. 'It prevailed,' observes Sir Gilbert Blane, in his remarks upon Mr. Corbyn's letter, 'to a degree equally violent at all seasons of the year: in regard to temperature, from 40° or 50° of Fahrenheit to 90° or 100°; in regard to moisture, during the continuance of almost incessant rain for months, to that dry state of the atmosphere which scarcely leaves a vestige of vegetation on the surface of the earth.' To which I may add, that it often fought its way in the very teeth of the most powerful monsoons, and left untouched various districts that bordered on its career, and whose less salubrious features seemed to invite an acquaintance with it. It appeared also and vanished in all the changes of the moon, and in all states of atmospheric electricity: and at sea as well as at land. Mr. Corbyn, indeed, gives an account of its having made an attack upon the Lascars of an Indiaman, in its passage from England to the Cape of Good Hope, in 1814; and that too in the month of January, when the weather was intensely cold.

It has, hence, by many pathologists been supposed to have been propagated by a specific contagion: and in support of such opinion they have endeavoured to show, that it appeared in no town or district where a direct communication had not been maintained with some place in which it was prevalent. In this endeavour, however, they do not seem to have been successful. Nor is it easy to reconcile the suddenness of its appearance and disappearance with the laws of contagion, so far as we are acquainted with them; a subject we shall have occasion to examine at large, when treating of fevers. Mr. Allardyce, surgeon to his majesty's thirty-fourth, informs us, that in this regiment the disease appeared on the 21st of September, and committed dreadful ravages before night. On the 25th it abated remarkably, and in three days more entirely vanished. In like manner, the severe attack which was experienced by the Bengal and Madras troops at Nagpore, occurred at the end of May 1818. On the 10th of June, the rains appeared with great violence, when the epidemy abated, and immediately afterwards ceased. Neither is the idea of a contagious propagation reconcileable with the escape of the great body of persons exposed to the influence of the disease, considering that, from its not being apprehended to be contagious, no means, as is usual in other cases, were employed to avoid the infection.

The state of the atmosphere, as described by Mr. Allardyce, did not differ materially from that in Nagpore. The disease made its attack in close and sultry weather, and vanished after thunder storms and heavy rains. But we can draw no conclusion from these phenomena; since it seems to have shown itself quite as frequently and fatally after a long succession of rain; and, as already observed, sometimes in very cold and dry weather. The remote cause, therefore, of this mysterious scourge remains yet to be ascertained, and affords further proof, if indeed proof were wanting, of our general inacquaintance with the nature and economy of epidemics.

With the exception of the plague, there is no epidemy on record that seems to have been so strikingly marked by violence and irregularity of action, and especially by a rapid exhaustion of living power; the patient, as we have seen, often expiring within twelve hours from the attack, and sometimes sooner.

The first characteristic feature that occurs to us, on a review of the disease, is the total absence of the bile from the whole range of the alimentary canal in every case, while this fluid was as generally found in abundance in the gall-bladder; and, perhaps, the next is, the turgid, and, in some instances, the ruptured state of the liver from the quantity of blood with which it was distended. The general battery of symptoms appears, therefore, to have been opened by a spasmodic constriction of the bile-ducts; for, without such an obstruction, we cannot account for an exclusion of all bile from the intestines. From this point, as from a centre, the spasmodic action seems to have spread in every direction, and under a clonic or entastic form to have seized upon almost every organ; preying with greater violence according to the greater degree of debility, and hence, perhaps, of irritability of the system; into which law, we are to resolve it, that the natives, supported by a less rich and nutritive diet than Europeans, suffered more severely, and died more frequently. The stomach and intestines, generally speaking, first participated in the spasm of the bile canals, and hence the griping pains, the nausea, and violent commotions, which spread from the one to the other.

In all cases of nausea, from whatever cause, we see the brain and the surface of the body peculiarly diminished in their energy; whence the skin, to the remotest extremities, collapses beneath a deadly chill, and the heart sinks with insupportable languor. In the ordinary course of sickness the nausea subsides, and the general organisation recovers its balance, or it terminates in full vomiting, which excites a universal re-action. And where any such re-action occurred, in the disease before us, it was hailed as a favorable change; and hence the wisdom of the stimulant plan so frequently had recourse to by the medical staff for the purpose of producing a revulsion. But, where this was not accomplished, the living power, feebly recruited from its fountain from the first, or not recruited at all, became exhausted in every organ apace, the strength failed, and hope gave way to despair. While the general mass of blood, thrown back by the contraction of the vessels of the surface upon the deeper and larger organs, produced effusion, congestion, and extravasation, wherever they yielded most readily; and hence chiefly in the liver, which in hot countries is almost always in a debilitated state. In the midst of these accumulated evils, the spastic diathesis, instead of being subdued or even checked, became, by the very resistence it met with, more forcible and aggravated. Every organ successively or simultaneously submitted to its torturing cramp; the heart

was fixed and incapable of propelling the blood through the arteries; the muscles of respiration were incapable of expansion, the lungs were collapsed, and suffocation was threatened every moment.

None of the natural secretions took place; the bladder was shrivelled and empty; the bile, while in the gall-bladder, became discolored and dark; there was no fluid, or only a morbid fluid, in the pericardium, and the intestines were no longer lubricated with the refreshing moisture of health. But, while these secretions were put a stop to, others took place in different organs from the mortal struggle of those organs themselves, and chiefly where the struggle was severest. And hence those morbid fluids, and other materials, exhibiting almost every degree of consistence, which were found in the intestinal canal, and often ejected by the mouth and anus; varying from the nature of chyle, thrown back perhaps, by a retrograde spasmodic action of the thoracic duct, to the nature of that mucous and unctuous matter which the intestines are sometimes capable of forming even under other circumstances.

I have said that the living power, during the whole of the melancholy contest, seems to have been recruited very feebly from its fountain, or not recruited at all. The latter appears to have been the case in the island of Ceylon, where the disease raged with even more violence than on the Indian continent, and the patient very frequently expired in twelve or fifteen hours from its attack. A dissection of those who perished thus early in this quarter has put us into possession of some interesting facts, varying in a few particulars from those that occurred on post-obit examinations in the island of Bombay, and which will, I trust, uphold me in making this remark. The brain was in these cases chiefly the congested organ, the liver sometimes appearing to have no congestion whatever; and hence the inactivity produced in the brain by the nauseating state of the stomach must have been greatly augmented by oppression. Consentaneous herewith, we are told by Dr. Davy, that, in some of the cases which he dissected in this region, there was a flaccidity of all the muscular parts, as in animals killed by electricity or hunted to death. There was also a tenderness of the muscular fibres; while antecedently to death, as in many of the Bombay cases, there was no difference in the color of the arterial and venous blood, and no instance of a buffy coat on the blood that was drawn; which in reality was so loose and uncoagulable that, when venæsection was necessary, the vessels were opened with the greatest caution from the difficulty of restraining the blood afterwards.

In all these cases there can be little doubt that the supply of the living power from the brain was spent profusely, and soon altogether exhausted: in some instances, indeed, nearly momentaneously; like the effects produced upon the animal frame by a stroke of lightning, a violent blow on the stomach, or any other accident that occasions instant death by a total and immediate discharge of the vital energy.

In other cases, the oppression on the brain, produced by congestion, seems to have put an end to the conflict before the living power had completely failed, and while it was still acting with irregular accumulation in various organs: for, in these, the muscles of the extremities, and even of the face and lower jaw, were observed to move in a convulsive manner, and sometimes to be drawn into tremulous knots, fifteen or even twenty minutes after death had closed the scene. So the heart of the traitor, when extirpated after he has been beheaded, from a like accumulation of sensorial power, has been seen to palpitate, and even to leap up for several times in succession after its removal from the pericardium.

Commonly, however, the living principle seems to have been exhausted more generally and progressively; and the muscles, and indeed most of the organs, freed from the tetanic power that at first constringed them, to have been gradually relaxed and flaccid: and hence that comparative absence of pain that occurred so frequently a short time before death, with the flow of a cold sweat over the surface of the body, and of bile into the smaller intestines.

I have thus endeavoured to follow up and explain the different symptoms of this complicated disease, many of which appear at first sight to be incongruous with each other and of difficult reconciliation. And we may hence see how well calculated the plan of treatment pursued by the different medical boards was to meet them, and may trace the ground of its success. The grand objects before them were: to equalize the flow of the living power; to counteract the spastic action so common to the irritable diathesis of hot countries; to guard against the danger of congestion in the vital organs; and to restore the natural secretions of the system. The great danger of congestion was guarded against by bleeding; spasm and irritability were opposed by powerful narcotics; and the full and repeated doses of calomel were admirably calculated to act upon the secernents and restore them to their proper functions, and especially when united, as was occasionally the case, and perhaps always ought to have been, with antimonials. All this was sometimes accomplished rapidly, and the disease ceased in a few hours. But if from the violence of the attack, or from any other cause, it could not be accomplished at all, such violence could not long be resisted; and the patient in a few hours, or at the utmost in two or three days, fell a prey to its fury.

We may also be enabled to see, from the general history before us, why the present species of cholera, or that accompanied with general spasmodic contractions, should occur more severely in the hotter climates of India, or indeed of any other torrid region, than in the more temperate ones of Europe. Cholera is peculiarly characterised by a tendency to spastic action: but hot climates have a peculiar tendency to excite a general spastic diathesis, and to develope this diathesis in some degree or other in all diseases; whence, more especially, the frequency of tetanus upon slight wounds of the extremities, or an exposure of them to sudden chills: and hence, from the co-operation of

these two causes, the graft of a spastic disease upon a spastic temperament, the effect must be of a highly multiplied aggravation. It is well known, however, that this spastic temperament, though common to such climates, is by no means equally common to every inhabitant: and hence again we see a predisposing cause existing in some cases, which does not exist in others, and are able to trace out something of the reason why the epidemy should not have been able to fasten upon every individual with equal ease.

It still remains, however, to be ascertained, besides inquiring into the nature of the remote cause, why this disease should have been so much more severe as well as so much more frequent within the last six or seven years, than in former periods; as also, why an affection of the liver, or of the bile-ducts, should be capable of exciting so extensive a chain of influence on the nervous, rather than on any other system.

Whilst revising this sheet for the press, Sir James M'Grigor has informed me, that the disease in the Mauritius did not appear till after the arrival of a ship on its coast from Ceylon, where the epidemy was raging; some of the crew of which were seized with it on their passage, though all were well at the time of sailing. As a single fact, this is not sufficient to prove contagion; but, in the present uncertainty of the subject, it is a fact worth treasuring in mind.'

406. *Diarrhœa.* Looseness.

' *Symptoms.*—This in some causes a sort of minor cholera, and according to its sources is or is not accompanied with much pain and irritation.

Causes.—These act either on the body generally, or upon the part or parts affected. Cold checking perspiration is a very common source of diarrhœa; mental agitation occasionally produces it. Dentition is a most frequent cause of looseness in the bowels, and sometimes metastasis of other complaints upon the internal membrane of the intestines, or upon the liver, will excite the disorder. Indigestion is a frequent source both of costiveness and looseness; indeed the former disease never exists to any extent, or lasts for any time, without thus in one way or other disordering the bowels. Sometimes, and indeed very frequently, and often when it has not been suspected, an erythematic inflammation of the mucous membrane of the bowels will be the occasion of diarrhœa: indeed a degree of the same affection which when more violent or confirmed will arrest secretion, causes constipation and becomes positive enteritis. In many cases a mere superabundance of bile will be productive of the malady, and occasionally a deficiency of that secretion will be followed by looseness.

Distinctions.—When the complaint is merely looseness, and is not attended with the discharge of hard scybalous fæces mixed with blood and mucus, and exciting tenesmus, it is positively and properly diarrhœa from whatever cause originating. To the disease, in the form just mentioned, we should apply the term dysentery.

Prognosis.—Diarrhœa if judiciously managed usually terminates well; if imprudently interfered with, dysenteric and inflammatory ailment may be the result, and the malady may then become tedious, intractable, and dangerous. See *Dysentery.*

Treatment.—The management of diarrhœa demands considerable attention as to its exciting and proximate cause. A gentle emetic will sometimes prove its best remedy when it shall have been excited by any thing of an irritating nature taken into the stomach; and even some old diarrhœas, which continue from habit, will be best counteracted by the administration of an ipecacuan emetic, which breaks into the series of morbid action constituting the complaint. When obstructed perspiration has produced the complaint, small doses of antimony and opium or ipecacuan and opium, will be its best remedies; to this last medicine the blue pill or very small doses of calomel may be added.

℞ Pulv. ipecac. comp. gr. v.
Hydrarg. submur. gr. ß.
Syrupi aut. mucilag. acaciæ q. s.
Fiat pil.: bis terve in die sumenda.

Take of compound powder of ipecacuan or Dover's powder five grains, calomel half a grain. Make them into a pill with mucilage or syrup; one to be taken two or three times a day.

When the diarrhœa seems merely to proceed from a laxity of the intestines, or their exhalant vessels, astringents will be called for, such as kino catechu, alum, or logwood.

℞ Tinct. catechu f. ʒi.
Aquæ cinnam. f. ℥iß.
Fiat haustus.

Take of tincture of catechu one fluid drachm, cinnamon water a fluid ounce and a half. Make them into a draught; or a fluid drachm of tincture of kino may be used in place of the catechu.

The chalk mixture, (mist cretæ of the pharmacopœia,) is an excellent medicine for a diarrhœa connected with acidity; and it is therefore a very useful formula for children's complaints; in these, however, we must be careful to give either small doses of calomel or hydrarg. cum creta; or, where much intestinal irritation is present, castor oil, in order to prevent the cretaceous medicine from proving too precipitately astringent or absorbent; for, although it may be often necessary to check the diarrhœa of infants, we must be cautious against doing it too hastily or completely, since it is often the consequence of nature's efforts to lessen the general or local irritation, which without this induced looseness might prove considerable and fearful. Where much pain is attendant upon diarrhœa, the opiate confection, as just advised under the head of cholera, will often effect a good deal of benefit; and it may be combined with still smaller doses of tincture of rhubarb, than there mentioned. The aqua calcis, taken in the dose of a few ounces with an equal part of milk, is recommended occasionally in protracted disorders of the bowels. When there is a tendency to dysenteric irritation, the simauroba bark in infusion with a small quantity of tincture of rhubarb may be administered. In the treatment of all kinds and forms and degrees of diarrhœa, warmth to the external surface, and to the feet especially, is demanded. Opiate liniments as advised under the head of cholera, or

in long standing cases opium and antimony to the surface in the form of ointment, may be adopted. When there is reason to suspect that the villous coat of the intestines has become the seat of small ulcerations, very small doses of calomel and opium, say a quarter of a grain of each, will be useful; and with this plan may be conjoined the administration of small doses, likewise of the copaiba balsam. Ten minims or fifteen taken two or three times a day, rubbed down with mucilage of acacia or yolk of egg.

407. *Diabetes.*

Symptoms.—Dryness and harshness of the skin, emaciation, weariness and indisposition to exertion, constipated bowel, urgent thirst, frequently a voracious appetite, with œdematous swellings of the ancles, and febrile irritation of a hectic character, are the usual symptoms of diabetes, beside its main characteristic, that of a large flow of urine, which is sweet to the taste, and has the odor of hay. There is also, for the most part, when the disease has been of long standing, an excoriation at the extremity of the penis. Of true diabetes (or diabetes mellitus, as it has been called to distinguish it from the complaints in which, as in the hysteric disease, there is a large flow of limpid urine), it is necessary to remark this hay-like smell in the urine, which is sometimes so marked as to be discoverable in the odor of the patient's body. Dr. Latham, who has written on diabetes, mentions this particular, and in a very candid way. He tells us that a patient called upon him, for whom, after having made some enquiries, he prescribed some medicine, under the notion of the patient being a mere dyspeptic; but, as he turned from him to go out of the room, this peculiar odor struck him as proceeding from the man's body; he recalled him in consequence, renewed his investigations with this clue to guide him, and found the individual laboring under a confirmed diabetes.

Causes.—A long course of diuretic medicine has been said to produce diabetes; it is for the most part, however, brought on by poor living, accompanied by spirituous liquors. It is more common in Scotland, and in the north of Ireland, where the poorer class of people live principally upon oats or potatoes, than it is with us. The water brash is likewise, as we have said, more common under these circumstances and localities, and an analogy has indeed been supposed between these two diseases. Occasionally the disorder is produced by exposure to cold, or brought on by mental anxiety; and sometimes its occurrence does not seem at all traceable to any circumstance of obvious excitation.

In respect to the proximate cause of the malady, or the actual condition of organs as its procuring cause, opinion differs. Some have supposed it to have particular reference to the lymphatic system; others have traced it to some morbid state or action of the liver. The stomach theorists have referred it to defective digestion and assimilation: while others have looked upon it as a depraved condition in the secretory power of the kidney. There are difficulties attendant upon all these hypotheses. Certain it is that dissections of those who have died of diabetes have usually shown the kidneys to be considerably affected; but whether this altered structure, and probably, by consequence, altered action, is the result of the malady, or its primary circumstance and absolute essence, does not seem very easy to settle. Then, again, the digestive and assimilating organs would seem to be implicated, on account of the extreme emaciation; but those pathologists who maintain that the disorder is one of the kidneys, and of the kidneys alone, remark that the emaciation is to be accounted for by the discharge of so much saccharine matter daily; and they urge that the stomach, the liver, the pancreas, and the spleen, are found for the most part in a healthy state, as far as structure is concerned, while, on the other hand, the kidneys are highly disorganised, sometimes exhibiting a high measure of vascularity, at other times much enlarged, and of a paler color than natural. It should be observed that the urine of a diabetic patient is not merely different from that of a healthy individual in thus being laden with sugar, but that it is at the same time destitute of the urea and ammoniacal and earthy phosphates that are found as ingredients in healthy urine.

Prognosis.—Very unfavorable. It may indeed be doubted whether a confirmed case of diabetes, that is, one which had existed for any considerable length of time, was ever radically and permanently cured. We remember some remarkable cases in the Edinburgh Infirmary, which were under the care of Dr. Hope, at that time clinical professor, and two of which were dismissed as cured, and their cure deemed manifestations of the good resulting from Dr. Rollo's plan of treatment, which we are immediately to mention. These two individuals returned soon to the infirmary, there died of diabetes, and dissection proved the kidneys in a high state of disorganisation. And we are told by Dr. Uwins, in his recently published work on disorders connected with indigestion, that he was favored with a communication some time since, from Dr. Buxton, to the following effect:—that he, Dr. B., had used the meat diet in five instances of confirmed diabetes; that he had found a rapid, a decided, and a beneficial effect in all. But that he had not known it cure in one example. 'All the patients,' he says, 'who employed this meat diet, soon became fatter and stronger, and made less water materially, and that of a less diabetic quality than before, and the amendment appeared most conspicuous in the worst cases; but the disorder ultimately proved fatal in all.'

Treatment.—Diabetes, like hydrophobia, has been endeavoured to be subdued by almost all the remedial plans which ingenuity could devise, or mere empirical feeling suggest. Diaphoretics have been employed with the very natural expectation of possible good, by diverting from the kidney to the surface of the body. Astringents have been tried, and tonics, and chalybeates, under the notion of restoring tone to the kidneys and the organs of assimilation. Large doses of opium have been thought of, and experimented upon, and this in some instances with decided effect of a temporary kind. The tincture of cantharides, from the specific influence which this medicine has upon the kidneys, has been un-

availingly used. Horse-exercise, daily friction of the surface, and rubbing the whole exterior of the body over with oil, under the impression that this might prevent the cutaneous absorbent from taking in moisture from the atmosphere. Large blood-lettings, in order to abate the conjectured inflammation of a chronic kind going on in the kidneys; the warm balsams, more especially the copaiba, from the known effect that these substances have upon the urinary organs; and, lastly, a complete abstinence from all vegetable diet and spirituous liquor, and putting the patient entirely and exclusively upon meat as food, and at the same time giving hepatised ammonia, or carbonate of ammonia as medicine, have all been tried, and almost all of them with immediate and temporary, but not, we fear, with radical and permanent, benefit.

'We are informed, however, by Dr. Ferrier, that he has actually cured three confirmed cases of diabetes by a combination of cinchona, uva ursi and opium, taken three times a day, in the proportion of a scruple of each of the former to half a grain of the latter; and that, from the great success he had met with from this medicine, he found it unnecessary to try Dr. Rollo's plan. The doses were taken with lime water, which was also directed for the patient's common drink;' and which probably might have had a very considerable share in effecting the recovery.

Dr. Rollo's plan, beside enjoining a thorough abstinence from vegetables, was that of administering hepatised ammonia in doses of three or four drops, gradually increased to the production of giddiness, or pills containing about four grains of the subcarbonate of ammonia, to be given about twelve in the day; the skin is to be at the same time anointed with prepared lard; at night antimonial wine, with opium, is to be given; an ulceration of about the size of half-a-crown to be formed over the region of each kidney, and the bowels to be kept free by aloes and soap.

[*Note.*—We might here mention several other changes which the urine undergoes in its chemical composition and essential characters, particularly in reference to its proportionate quantity of urea: but as this subject is at present undergoing minute investigation by the labors of animal chemists, more especially by Dr. Prout, we have thought it better to defer the more particular notice and discussion of these points, till we come to speak more specifically and particularly of the composition of urine, in the article PHYSIOLOGY. Its chemical analysis is also examined under the head of *Urine*, in the article CHEMISTRY.

408. *Hysteria.* Hysteric disease.

Symptoms.—The definition is very accurate in respect of the main symptoms, but hysteria brings in its train such a numerous assemblage of symptoms, that to describe them would be to go almost the whole round of sympathetic, or, as they have been termed, simulative or mimositic maladies. The suffocative feel noticed in the description is often accompanied by a hurried or oppressed respiration, by distressing flatulence, and sometimes a feeling as if, could the pent-up wind be removed or expelled, every thing would go on well—the fear of death is remarkably characteristic of the hysteric disorder in its heigh. of manifestation, and the patient does often for a time lose consciousness, and to bystanders the appearance of life. On the day previous to penning this account, we have seen an hysteric patient, who had just recovered from one of these fits of syncope, and who described his sensations (for in this case the patient is a male) as highly distressing, and scarcely bearable during the progress of recovery. Shedding tears is remarkably characteristic of hysteria, and often gives much temporary relief to the sufferer.

Causes.—Nervous mobility is the predisposing cause of hysteria; and it is excited by all causes of irregularity, such as irritation from undigested food or from worms; alternations of temperature; crowded heated rooms; late hours; mental agitation; a diet either immoderately full, or too abstemious: some indeed talk of it as they do of every thing else as the result of irritation in the digestive organs exclusively; but we often see persons the subjects of the affection who are exceedingly regular in respect of diet, never experience any inconvenience from their meals, and are altogether without any manifestation of digestive disturbance. That the cerebral and sympathetic nerves are affected is obvious enough, but then it is not the stomach or its appendages that in these cases are implicated, except in a secondary and incidental manner. The ancients used to imagine the seat of the disorder to be the womb, and the globus hystericus, or suffocating ball, or sensation as if of a ball rising up in the throat, or more properly speaking the wind-pipe, was supposed to be an actual something rising from the womb—hence the name hysteria; but this idea is of course in the present day abandoned, although the disorder itself has very often a most manifest connexion, sometimes primary and sometimes in a secondary incidental way, with uterine conditions.

Prognosis.—For the most part favorable, unless when it depends upon some organic affection, as an inflamed or otherwise disordered brain; and, even then, it is not from the hysteria, however violent, that danger is to be apprehended, but from those affections which may have produced it.

Distinctions.—Epilepsy and hysteria are nearly allied; but the latter, even in its most violent forms, is without the foaming at the mouth and horrible convulsions characteristic of the former, while an epileptic has not that feeling of suffocation, or globus hystericus, which the hysteric subject has. Hysteria too is usually a disorder of females, though not as we have just said invariably.

Treatment.—Ascertain whether the disorder is sympathetic upon stomach or bowel, or uterine irritation, and if so, give purgatives and anthelmentics. If there be much plethoric fulness, and especially if the mobility of the system seem to have connexion, with fulness about the blood-vessels of the head, bleed from the arm, or apply leeches to the temples, or behind the ears. If a foul stomach is suspected, an emetic may be administered. In cases of costiveness, Dr. Thomas tells us that he has seen very speedy

and effectual relief obtained by administering the following enema:—

℞ Ol. terebinth, f. ʒiij.
Mucilag. acac. f. ʒß.

Misceantur benè simul in mortario et adde decocti avenæ, f. ℥xi.

Fiat enema.

Take of oil of turpentine three fluid drachms, mucilage of acacia half an ounce. Mix them well together in a mortar, and add thin gruel eleven ounces, for a clyster.

Antispasmodics may be given by the mouth, as soon as the patient is found capable of swallowing, but perhaps there is not so much to be expected from this class of medicinals as some imagine. One of the most useful medicinals of the nervous class appears to us to be valerian, which may be administered in the form of the ammoniated tincture, a tea-spoonful two or three times a day, or given as an infusion, in the proportion of half an ounce of the root to a pint of boiling water, and a wine glassful of this infusion taken two or three times a day.

When dyspeptic symptoms are present, especially should there be an accompanying acidity, the combination of magnesia and ammonia, as mentioned under gout, may prove of great service.

When it has been ascertained that merely morbid sensibility, and consequent mobility of the nervous system, is in fault, the metallic tonics may be administered; and one of the best is the nitras argenti, which may be commenced in doses of half a grain two or three times a day, and carried up to the extent of two or three grains. The oxides and sulphate of zinc, and the ammoniated copper, or ammoniated iron, may also be administered with the same view of lessening the sensibility and mobility of the nerves.

We have all along spoken of those symptoms that are common to the hysteric form of disease as simulative of formidable affection, rather than in themselves formidable; they are in common language nervous; and, although as real to the sufferer as those attendant upon organic disorder, are nevertheless essentially different, and require to be recognised as such by the practitioner. In a work recently published on nervous and digestive derangements, one section is devoted to the prominent marks of distinction between those affections which have most to do with the nerves, and those which rather implicate other parts of the frame, and we cannot have a better opportunity than the one now afforded us, of incorporating the section of the work alluded to in this article.

The maladies, says the author from whom we extract, which have been the subject of disquisition in the preceding pages are those, for the most part, of the sympathetic kind, as opposed to actual or structural disorders; and it may not be improper to add a cursory remark or two to those which have already been made respecting the particular features of distinction traceable between affections which are thus rather nervous than organic, or which are disorders of action rather than disorders of structure.

One of the most prominent circumstances of distinction between the one and the other may be taken from the pulse; for, in the fugacious and simulative affection, you will not find the arterial beats of that uniform and steady quickness which is characteristic of topical disturbance influencing the general frame. It is curious, indeed, to observe how the pulse of a nervous patient shall vary with varying circumstances. I have just seen a lady in the Kent Road, about whom there was some little reason for hesitation as to the extent to which the liver might have become implicated in the general derangement that was pervading the system: I felt her pulse, and found it, at my first coming into the room, quick and irritable; but, as it wanted that peculiar hardness or wiriness of character that marks topical inflammation, I hoped that, when the patient should become a little familiarised to the formidable appearance of two medical men standing by her bed-side, the temporary ruffle of the circulation would subside; and the event proved me to be right in my anticipations. I left the person in question with a pulse beating fifteen strokes in a minute less than when I first felt them; and I left her with a feeling, in a great measure founded upon the particular referred to, that although there was some measure of liver disease, it was not so formidable and extensive as I should have inferred it to be had the pulsations continued, from the first to the last, of a uniform celerity.

It is a curious fact that, when an actual affection of an organ takes place, the individual who is the subject of it often becomes less nervous, as it is called, or timid and apprehensive, than he was before; and the quickness of the pulse, which forms one of the characteristics of the new disorder, is not by any means regulated, as it was before, by the feelings and fears of the affected; and in this case there will be none of that momentary hurry and eventual calmness that, in the way just intimated, marks the mimositic as opposed to the real disorder. The term, by the way, real disorder, it is hardly proper to employ; for the malady is as actually existent in one case as it is in the other; and that physician knows very little of the laws which regulate the sentient organisation, who shall consider an ailment a matter of fancy, because it has no tangible essence or structural character.

With celerity there is, for the most part, a hardness of pulse when the blood-vessels are more engaged than the nerves, or when the general irritation is an index of some local disturbance of an inflammatory or irritative nature. This change in the pulsations, from a healthy condition, is indeed scarcely recognised by some physicians; and the late Dr. Heberden used to avow his carelessness about pulse beyond the mere number of its beats. 'If your patient,' says the author just named, 'has a pulse which regularly beats more than 100 in a minute, I should infer, that the affection of which he is the subject is somewhat dangerous; but I cannot go along with some individuals who talk of this and of that kind of pulsation as indicating the kind and measure of disorder.'

Others, again, profess an almost total disregard of number, and confine their observations,

and deduce their inferences, from mode almost alone. My own opinion on this head is intermediate; and although I consider the kind of pulsation an important point of recognition, and although I can find topical and inflammatory affection attended with hardness as well as celerity, and the more symptomatic and fugacious disorder without this same wiry character; yet I must confess that I cannot follow some of my professional brethren in all their apparent nicety of observation. In this respect, however, there is confessedly a good deal of difference as to tact. The late Dr. Gregory, of Edinburgh, used, I recollect, to say in his lectures, that he could seldom detect the fluctuation of dropsy which was so evident to others who might be in attendance with him; and we must, therefore, ascribe the difference of sentiment with regard to pulse, in a great measure, to the varied power of the individual of perceiving the varieties. At the same time, some may probably affect to have, or cheat themselves into the supposition of having, more delicacy of perception than is positively the case, —just as some would profess to feel, or fancy they felt, more pleasure in musical sounds than they actually do, merely because the want of the pleasure might be thought to imply a general deficiency of sentiment or taste.

The state of the spirits is another circumstance which will materially assist the decision, when assistance is wanted to judge between functional and organic disturbance. Those who have much fear about them have, for the most part, less cause for fear; and, when individuals tell you that they feel a presentiment that they shall die of disease in the lungs or the heart, you may generally conclude that their gastronymic system of nerves requires more correction than the condition of the organ about which their apprehensions are so much upon the alert. I have already, indeed, intimated, that, with the coming on of organic malady, a firmness and fearlessness of mind very frequently accompanies it. The late Dr. Reid, in his essays on nervous affections, tells of 'a lady who had, for a long time, been a miserable victim to the vapors, but who was completely cured of this complaint by the supervening of another which was more immediately alarming, and which precluded, indeed, the possibility of much longer life. No sooner,' continues the narrator, 'was the new disease ascertained to be an aneurism of the aorta, and the necessary result of that complaint was explained to her, than all her nervous feelings vanished, and she even bore the announcement of her inevitable fate with calmness. Hypochondriasis,' he adds, 'may often thank calamity for its cure.'

The countenance, in general, of a person laboring under organic disorder, is very different from one whose complaint is merely simulative or sympathetic; and the difference, like that of the pulse and the spirits, principally consists of the greater permanency and steadiness, as it were, of alteration from the physiognomy of health in the one case than in the other. There is, in the subject of organic disease, a continued sharpness and fixedness of feature which is very observable, and which the merely nervous patient is without; and when the stomach, but more especially the liver, happens to be the residence of the organic disorder, this fixed cast of countenance is accompanied by a peculiar anxiety of expression, or rather perhaps, I should say, of despondent indication. The term anxiety should rather apply to the physiognomy of a person with merely sympathetic malady; but then it is changed with the changing feelings that pass through his mind. I think it likely enough that an observant spectator would have perceived a marked change in the marked countenance of the late ruler of France, from the time that the general perturbation, of which he was the subject, resolved itself into a fixed point, and he became the subject of a topical and organic complaint.

It should be remarked that, when dyspeptic conditions are the occasion of the disorder, the precise nature of which we are desirous to learn, there is often a muddiness or dirtiness, as it were, of the skin, owing to the secretions of the surface being in sympathetic connexion with what is going on in the interior. Dr. Saunders, I think, in his treatise on liver complaints, speaks of this condition of the surface as peculiar to the dyspeptic or hypochondriac, who feels as if his skin constantly required washing; but this is a very different condition of the surface from that which is the indication of organic malady, accompanied by the sharpness and fixedness of feature just alluded to.

Emaciation, for the most part, accompanies organic malady, more especially if the organ affected be connected at all with the assimilating process; but, even in pulmonary affection, you find the patient sensibly losing his flesh and strength, while he himself is less sensible of the change than the hypochondriac sufferer, who feels himself rapidly wearing away, and is surprised that the change is not so observable to by-standers as he should suppose it would be.

When perspirations accompany fixed and organic disorder, they are more regular in their recurrence; they assume more of the hectic shape; they break out in the morning, and are, for the most part, rather confined to the upper part of the body; they are of a colliquative cast, as it is called; that is, they seem as if the frame were melting away under them, while the perspirations of the sympathetic complainant, although often profuse, are not so steady with respect to time, not so certain as to the part of the body upon which they break out, nor of so melting or dissolving a character. This distinction, indeed, more strictly applies to pulmonary affection; but it may be extended, with some qualification, to many others.

The pains of organic and sympathetic disease are remarkably different; and the difference relates partly to the locality of the affection, and partly to the state of nervous susceptibility of the patient. When the substance of an organ is implicated, and is wearing away under the malign influence of structural malady, the individual shall, at times, be scarcely conscious of pain at all, while the pain produced by nervous susceptibility, being called into actual consciousness, will prove, though perhaps transient, while it does last, comparatively severe.

The shivers, or rather rigors, which accompany disease, are very different in their aspect and character, as they shall be the indices of nervous or inflammatory affection. In the former case they will be fugacious and uncertain; in the latter fixed and regular.

Flatulent feelings and expulsions of wind are remarkably characteristic of nervous or sympathetic disorder; of the inflammatory or organic they are much less so. We may not, perhaps, subscribe to the medical axiom, ubi flatus nulla inflammatio; but, for the most part, where there is much of flatus, there is little of formidable disease.

When the seat of the disorder may be such as that you can make pressure on it with your hand, you will often find merely spasmodic or nervous ailment mitigated by the pressure; while if inflammation be going on, however slow and insidious, the patient's countenance, though he may not wish to acknowledge it, indicates that you occasion pain by the pressure. This is especially observable when our investigations are directed to the existence or not of liver affection, for here we press upon substance uninterfered with by bony parietes. In the case of chest affection, we must be guided by general distinctions, occasionally assisted by the ear, the ear itself being assisted by the stethoscopical instrument lately invented by our ingenious neighbours, the French, and brought into considerable use in this country. Although a little over forty I hope I am still young enough to listen to any suggestions by which a promise is made of forwarding the progress of medical science; and I do not feel inclined to deny, that the naked ear may be thus occasionally assisted by this artificial method of concentrating and conveying sound: but after all the ear is of much less use to us in medical investigation than the eye and the touch; and I am inclined to think that some of the boasted stethoscopical discoveries are like the salt on the bird's tail,—not made, till you have pretty well made them out by other means.

In a word, the sympathetic, or nervous, or mimositic patient, is always ready with his complaints: he will tell you of feelings about his eyes, of ringing in his ears, of pain in all parts of the head; and from the head he will traverse, with his bewailings, the whole topography of his body down, literarily ad calcem; he will call his physician back, after having detained him some half hour or longer, to add to his catalogue of miserable items, or to ask 'what he shall eat, or what he shall drink, or wherewithal he shall be clothed;' while, on the contrary, you are often obliged to force from the other individual what you do get in the way of information, and he is quite as glad as is the medical attendant when the time of the visit is over.

Hydrophobia. Canine madness; dread of water.

Symptoms.—A dread of water is perhaps rather erroneously considered as a characteristic of this dreadful malady; for there is no other fear of it than that which arises from the patient's finding himself incapable of swallowing it, without producing most distressing convulsions about the pharynx; the mere sight indeed, or even the hearing of water dropped, will occasionally bring on this horror and dread; but then it is produced almost involuntarily and necessarily from the recollection of previous suffering. The commencement of the disease is attended with extreme anxiety and general timidity, accompanied by a sense of suffocation, by intolerance of light and sound, by a secretion sometimes of saliva from the mouth, and by a remarkable susceptibility to the slightest motion or agitation of the surrounding air. Epilepsy and very violent hysteria are the diseases which more resemble hydrophobia than any thing else; it is not long since that we witnessed an extreme case of the latter disease which so much simulated hydrophobia, as to lead to the suspicion that the subject had been bitten by a rabid animal. It was in the last mentioned particular that the resemblance was so near, that, namely, of extraordinary agitation produced by the slightest agitation of the air about the patient. Towards the close of hydrophobia more frightful manifestations are presented, and the subject of it often dies within twenty-four or forty-eight hours from the attack.

Causes.—It should appear that the disease may arise spontaneously in the animal that imparts the disease, and it is mostly confined to the dog and the cat; but that, for its production in the human species, the matter must be received by the rabid animal, and must enter the blood-vessels; so that if some of the saliva should accidentally get on the skin, without penetrating it, there is nothing to be feared. It may be remarked that a degree of the disorder may be produced by a highly irritated dog or cat which is still not irritated into actual madness; and the apprehensions of the bitten would be calculated to establish the simulated malady; but although the symptoms in these cases might for a time resemble real hydrophobia, (and the imagination itself will work up this condition,) yet the termination in the one and the other case would soon prove the difference. With respect to the time which the virus may be latent in the system without coming into actual operation nothing certain has been ascertained. Thus much is certain that weeks and months have elapsed between the infliction of the injury and the production of the disorder.

In regard to the proximate cause of the malady, it has in this case, as well as in tetanus and other violent affections of the nervous frame, been endeavoured to be proved that some spinal, or tracheal, or cerebral inflammation, has been the immediate result of the poison's influence, and that the external showings of the distemper have depended upon these local inflammations; but the extreme irregularity in morbid appearances after death are seemingly inconsistent with these theories; and it is perhaps more correct to infer that the primary action of the virus is rather upon the nervous organisation, and that these congested and inflammatory conditions are consequences rather than causes of the general perturbation.

Prognosis.—In the highest degree unfavorable: indeed it is doubtful whether any real case of hydrophobia has ever yielded to any medicinal trials. We have conversed with a medical prac-

titioner of respectability in Hertfordshire, who affirms that he once saw the actual symptoms of hydrophobia arrested by the employment of a ouack medicine which has gained celebrity in that part of the country, and which is supposed to be constituted of very large doses of meadow saffron; but even in the face of such evidence we cannot help being sceptical when we hear all around us of the constant failure of all trials.

Treatment.—Of this then of course nothing need be said, excepting that excision of the bitten part ought to be had recourse to as soon as possible, and during the absence of a person who should be equal to this incision, a tight ligature ought immediately to be made round the limb between the bitten part and the brain; for it seems that this may for a time be preventive of the reception of the poison into the system.

On the subject of incision and prevention, we may be permitted to extract the following remarks from Dr. Thomas.

As in rabies, when once manifested in the system, the power of medicine and all human skill have failed in most instances, our views should be early directed to prevent the accession of the disease; and for this purpose the most effectual is excision of the wounded part, with free ablutions and scarifications. Immediately, therefore, on the infliction of the bite, or as soon afterwards as possible, ablution with water and soap should be had recourse to, and be continued until professional aid is procured. On the arrival of the surgeon, a free and complete excision of the bitten part is to be made, taking care to carry the knife to a sufficient depth, so as to ensure its complete removal. The excised part, being removed, ought carefully to be examined to see if there is any place in the piece through which the dog's teeth appear to have passed; and, in case there is, the excision ought to be carried still deeper than before. Should the knife, on a close examination, appear to have entered the wound made by the dog's teeth, it may be adviseable to recommence the operation with a clean knife, lest the other should be contaminated by its having entered the wounded parts, and by which the sound ones might become inoculated with the canine virus.

The sooner that the wounded part is extirpated after the accident the better; but it will be right to do it even at the distance of several days, rather than that the person should be debarred of the chance which excision affords, as there is great reason to presume that the canine poison does not enter the system so quickly as a variety of others are perceived to do. This conclusion we are somewhat authorised to draw, as in several well-attested cases, many weeks, nay months, have intervened between the accident of being bitten, and the appearance of the disease. If the bite be of long standing, and the wound consequently cicatrised, and there be a certainty that the animal by which it was inflicted was really rabid, it should immediately be laid open, cauterised, and caused to suppurate.

Dr. Darwin observes, that if the patient is bitten in a part which could be totally cut away, as a finger, even after the hydrophobia appears, it is probable it might cure it, as he suspects the cause still remains in the wounded tendon, and not in a diffused infection tainting the blood. Hence there are generally uneasy sensations in the old cicatrix before the hydrophobic symptoms commence.

Even in cases where assistance has not been requested until the consequent disease has already appeared, I am of opinion that the wounded parts should be excised: for if the excision of the part, in which the virus of small-pox, syphilis, or any similar disease is deposited, after the local action has evidently commenced, prevents absorption, and consequently the complete formation of the general disease; what reason is there for supposing that the same effect would not result from this operation, at the same period, in the case of the bite of a rabid animal; if the poison enters the system by the absorbents.

After excision, ablution is again to be performed with a solution of volatile alkali in water, and, when the flow of blood begins to cease, suction with the cupping-glass may be resorted to. The alternate employment of ablution and the exhausted receiver may be continued for some hours. Having proceeded thus far, caustic, such as the argenti nitras, or potassa fusa, may be applied to the wound, so as to produce a slough in the first instance, and afterwards a purulent discharge for some weeks. By this mode of treatment many persons have been known to escape the disease; while others who have been bitten by the same animal, and who neglected these means, have become affected.

It sometimes happens that the wounded or bitten part is so situated as not to admit of excision, or from the timidity of the patient he cannot be persuaded to submit to the operation. Under this dilemma we must be content to have recourse to a careful and persevering ablution, and afterwards to scarification and cupping, bathing the parts with warm water to promote a free flow of blood, in order to assist in washing away any remaining particle of the poison. With respect to the fluid to be employed at first in the ablution, a weak solution of volatile alkali, in the proportion of one part of the alkali to four of water, may be as proper as any we can use. With this solution, which is fully capable of dissolving the saliva, the wounded part should be freely washed, and injections with a syringe forcibly be made into the wound. After this, water may be substituted to assist in washing away any remaining particles of the canine poison. Having washed the wound for a considerable time, it may be touched with caustic, the argenti nitras, or the potassa fusa. Ligatures above and below the wounded part have been recommended during the ablutions by Dr. Percival, when they can be put on.

The bitten part must be destroyed to the bottom, by repeated applications of the caustic. To assuage the inflammation caused thereby, the wound is to be dressed for some time with poultices, and afterwards with acrid dressings and hot digestives, to remove the eschar, create a discharge, and drain the injured parts. Where there has been any delay after the accident, the wound should thus be kept open for two or three weeks, or even longer.

From some experiments made by Dr. Linke of Jena, with the saliva taken from a mad dog after it was dead, and that had bitten other animals with a fatal effect, the external application of a strong solution of white arsenic in water, to wounds besmeared with the poison, appears to have been attended with the happy effect of destroying the virus, and of preventing the disease from taking place. The remedy seems therefore worthy of further trials in wounds made by rabid animals.

Under the head of animal poisons it is mentioned that the external application, as well as the internal exhibition of the liquor ammoniæ, was found on many trials entirely to do away the injurious consequences arising from the bite of the cobra de capello, a snake of the most venomous kind, and productive of symptoms pretty similar to those arising from a rabid animal. The same remedy would, therefore, seem worthy of a trial in cases of hydrophobia; but as there would be great difficulty in administering caustic volatile alkali in a state necessarily diluted with some mild bland liquor, where the increased sensibility of the fauces and the dread of liquids are so strongly felt, we might convey it into the stomach in the manner practised by Mr. John Hunter, and hereinafter mentioned, or we might mix the volatile alkali with crumbs of bread, and form the mass into pills, or a bolus. (Stomach pump.)

In addition to these modes of prevention, it has strongly been recommended to commence, very speedily, a course of mercurial unction, which is to be continued regularly, and to be applied in a considerable quantity at once, so as to occasion some degree of salivation; to expedite which the submuriate of mercury may be given internally night and morning, and warm-bathing be used occasionally. Mercurial fumigations may also assist.

With the design of exciting a rapid salivation, in hydrophobia, Dr. Darwin has suggested that one grain and a half of the hydrargyri oxymurias dissolved in half an ounce of rectified spirit may be given frequently to the patient with a prospect of advantage. From a paper by Mr. Addington of West Bromwich, inserted in the Contributions of Medical Knowledge published by Dr. Beddoes, it appears that a similar mode is adopted by him for the cure of gonorrhœa virulenta, and that he has cured hundreds in a very short time in this manner, without the least disagreeable consequence. He directs us to proceed as follows: three grains of hydrargyri oxymurias are to be dissolved in one ounce of rectified spirit. Half of this mixture is to be taken undiluted at going to bed; it produces a copious salivation for an hour and a half, or longer, during which the patient spits about a quart. Some aperient salts are to be taken on the second day after this operation, and on the evening of that day he is to repeat the draught, and the salts on the day but one following.

Dr. Thomas Reid, in a pamphlet which bears the title of Observations on the Application of warm and cold Sea-bathing, recites a case which strongly attests the preventive effects of mercury. He makes mention that a man, a woman, and several dogs, were bitten by a supposed mad dog, who was soon after destroyed. A fortnight after the accident, he saw them; the woman was slightly wounded in the little finger, a black scab remained on the puncture: she had great pain in the arm, shooting up to her head, particularly in the night, with disturbed and frightful dreams, and great depression of spirits. The man had been bitten in the hand also, but had not so much pain. He directed mercury for them in the manner published by Dr. James. In a few days the symptoms abated; and, as the woman's mouth was sore, she desisted from using it. The pain, however, returned very soon, greatly augmented and affected her head; she resumed the medicine, and every symptom vanished; they both remained perfectly well. Had any return of the disease taken place, he is certain he should have been informed of it.

Dr. Reid further mentions, that the same medicine was given to dogs; but by some accident one of them was forgotten, and took none; he became raving mad the thirtieth day, and in that state he had him shot; all the other dogs remained well, except a small lap-dog, which died of the salivation. Neither the man nor woman supposed the dog to have been mad, until they began to take the medicine; the mind had therefore no influence in producing the symptoms that ensued.

These facts seem well authenticated, and strongly attest the good effects of mercury, when used at an early period. During the actual presence of the disease, its inutility has been proved in numberless instances. Dr. Mosely has, indeed, recorded a case of recent hydrophobia, and timely discovered, which was successfully treated by exciting a rapid and plentiful salivation by means of an ounce of strong mercurial ointment rubbed into different parts of the body at four frictions within forty-eight hours.

Dr. Richard Pearson, of Birmingham, in his Treatise on Hydrophobia, offers it as his opinion, that if the disease has ever been cured by mercury, it has been in consequence of a counter-impression communicated to the whole system, and not in consequence of the salivation; for a salivation is a constant symptom of the disease, so that if it were curable by a flow of spittle, it would cure itself. This seems, however, a vague mode of reasoning.

410. *Insanity.*—We now proceed to treat of that order of maladies which Dr. Cullen considers mental or vesanic, in contradistinction to those which are merely nervous. The qualification with which this peculiarity of disorder is to be admitted will be commented on as we proceed; meantime we announce our intention of treating madness in a manner somewhat different from that which we have adopted in reference to other affections; and we shall conclude the genera amentia, melancholia, and mania, under one division. Oneriodynia will afterwards fall to be noticed separately.

In endeavouring to define insanity, we meet with difficulties which are peculiar to itself, since there is a want of an entire coincidence in sentiment respecting the precise standard of mental health; and, until such standard be agreed on by universal consent, the deviations from it cannot of course be easily pointed out with that

decision and accuracy which correct definitions demand.

By one writer, 'an erroneous judgment and irrational conduct,' have been described as the essentials of insanity. In this definition, however, it is immediately seen that a fixed point of rationality and rectitude is assumed, which we have just stated does not exist in the common consent of mankind.

The same objection lies against that announcement of mental alienation which makes it consist in the want of correspondence between the estimate and real value of things.' 'If every one,' says Dr. Darwin, 'who possesses mistaken ideas or puts false estimates on things, were liable to confinement, I know not who of my readers might not tremble at the sight of a madhouse.' Even the objector, however, to the above definition admits too much. As there is no standard of rationality in the sense the above definition assumes; so, in strictness of language, there is no admissible difference between false and true with respect to our 'estimate of the value of things.'

The miser locked in his solitary closet, and lost in the contemplation of his golden stores, is regarded as insane by the youthful voluptuary, who has no other notion of the value either of specie or paper but as they furnish him with the means of sensual gratification; with the latter, however, the former is equally in his senses, provided he act, as indeed he necessarily does, in conformity with his inclinations, or, in the words of the definition upon which we are commenting, 'his estimate of the value of things.'

Neither will Darwin's own definition bear the test of rigid scrutiny. 'Madness,' says this author, 'is an excess of action in the sensorial power of volition.' In this account we must necessarily include the late emperor of France. Where is the man whose volitions were more in excess, during the zenith of his power and splendor, than Napoleon Buonaparte? Yet, however desirable to Englishmen it might always have appeared that this extraordinary individual should as soon as possible be put out of harm's way, we surely never could have desired his confinement on the score of his being a maniac.

Again, it is not the volition, but the influences operating upon the mind to engender the volition, which form the criterion of the healthy or deranged condition of the understanding. 'Madness,' says a modern author, with equal force and propriety, 'is not a disease of action, but a disease of motives to action.'

In that very entertaining section of the Zoonomia which is devoted to the subject of mental hallucination, we find it stated that a gentleman ordered his servants to be all stripped before him in order to examine them. In consequence of this procedure he was confined as a maniac; and, after much persuasion, he was prevailed upon to tell the medical attendant that he had got the itch, and that he had determined to examine all his domestics separately and minutely in order to ascertain from which of them he had contracted it. At the time, however, of this transaction, there was not a spot to be seen on the individual's hands, or on other parts.

Now in this case the hallucination consisted not in the volition to satisfy the particular conceit, but in the conceit itself; it was a derangement rather of sensation than volition, or, more strictly speaking, the complaint was constituted by strength of passion, rendering the ideas of conception more prominent than those of perception; and, by consequence, producing a volition which, although wild and incongruous in reference to former feelings and associations, was in conformity and consistency with such as at the time prevailed. In like manner, if conceiving, or in other words believing, myself to be too bulky to pass through a door-way, like the late Dr. Watts, I will, or order, its dimensions to be increased, neither are my volitions inordinate nor my reasonings incorrect; nor are they so, if, like the mad philosopher in Rasselas, actuated by the consciousness of possessing power over the elements, I will and command the thunder to roll, the lightning to flash, and the rain to fall. 'He does not,' says a modern author, 'reason falsely, but more properly furiously deceives himself; who, fancying himself to be Jove, hurls Jove's thunderbolts,—Non malê ratiocinatur, sed potius furens decipitur, qui Jovem se credens Jovis fulmina jaceret.

Dr. Mead makes madness to consist in 'increased strength of imagination.' But by this enunciation the poet, or the man of inventive genius, is classed with the insane, and Shakspeare and Milton are made to stand highest in the list of maniacs. 'The strength or increase of any power of the mind,' says Haslam, 'cannot constitute a disease of it. Strength of memory has never been suspected to produce derangement of intellect, neither is it conceived that great vigor of judgment can operate in any such manner. On the contrary, it will readily be granted, that imbecility of memory must create confusion, by obstructing the action of other powers of the mind; and that, if the judgment be impaired, a man must necessarily speak and generally act in a very incorrect and ridiculous manner.'

Dr. Arnold, who has written very largely on the topic now under discussion, divides insanity into ideal and notional: the first he defines that state of mind in which a person imagines he sees, hears, or otherwise converses with, or perceives persons or things, which either have no external existence to his senses at the time, or have no such external existence as they are then conceived to have, or, if he perceives external objects as they really exist, has yet absurd and erroneous ideas of his own form, and other sensible qualities.

Notional insanity, he says, is that state of mind in which a person, hears, sees, or otherwise perceives, external objects as they really exist, as objects of sense, yet conceives such notions of the powers, properties, designs, state, destination, importance, manner of existence, and the like, of things and persons, of himself and others, as appear obviously and grossly erroneous or unreasonable to the common sense of the sober and judicious part of mankind.

With respect to the first of these distinctive delineations of the constituents of insanity, it may be observed that the definer, although neare

correctness, perhaps, than some others, seems to suppose that false perception implies an absolute and abstract difference in the object perceived; and as to the second division it is obviously in some sort objectionable, upon the same principle upon which we have ventured to object to some other definitions, namely, that it assumes a test of notional rectitude, which neither does nor can exist. How absurd do the notions which the miser entertains of the nature and value of money, appear to the majority of mankind! and yet we cannot with any propriety attach the imputation of madness to either the notions themselves or the resulting conduct. Indeed the ad absurdum extreme of Dr. Arnold's position, respecting difference of opinion as constituting insanity, would make the much talked of remark of the Bedlamite to be as sensible an assumption, as ever was put into language; who, upon being questioned as to the why and wherefore of his confinement, replied, 'The reason, Sir, is this; I conceive the whole world to be mad—the world, returning the compliment, supposes me to be in the same predicament, and, the many being more powerful than one, here they have locked me up.'

In what then, to return to our query respecting definition, in what does insanity consist? In our remarks on one of Dr. Darwin's examples of mental hallucination we have stated that strength of sensation or passion, rendering the ideas of conception more forcible than those of perception, gives birth to incongruity of association, and consequent incoherence of gesture, speech, or action. Of this disordered association, then, is insanity formed; by incoherence of conduct is it displayed; and by the intensity of the prevailing sentiment or passion has it been produced.

We would therefore define madness, intensity of idea causing imagination to be converted into actual belief; and it will now be our endeavour to illustrate and defend this position, as well as to point out what we conceive to be the practical importance of thus considering the line of demarcation between mental health and disease, to be mainly, if not absolutely and entirely, made up of difference of belief or persuasion.

Suppose an individual to be present at a theatrical representation. Let his imagination be warmed, and his passions excited by the scenes which are presented to his senses. Let him follow with ardor the fortunes, and engage with interest in the events, connected with the principal personage of the drama. Still he has no belief in the actual existence of the fictitious character—or at least his belief, if it does exist, is merely momentary. Otherwise he would not applaud the faithfulness of representation in the actor, but the passion which the actor feigns. Again, our individual admires the beauty and fidelity to nature of the scenery, but he does not therefore suppose himself transported to the actual place which the scene represents. In other words his heightened conception or imagination still stops short of the pitch of overpowering his perceptions. Suppose, however, that the vividness of the representation should hurry the feelings and exalt the fancy to such a degree of intensity, as to break into, and in a manner overwhelm, the usual order of perceptive ideas; the spectator would now be carried above the reach of reason or of truth, he would actually, as a modern writer expresses it, see Alexander and Cæsar before him in the persons of his old familiars, a room illuminated with candles now comes to him to be the plains of Pharsalia, or he believes that his walk to the theatre has been a voyage to Egypt, and that he lives in the days of Antony and Cleopatra.

Allowing then the correctness of this assumption, respecting the essentials of insanity, we might say in other words that it is delusion more transient, or more permanent, more partial, or more general; the imagination having overwhelmed the perceptions, and the understanding having fallen prostrate under the violence of the conflict.

Vividness of imagination, then, although in itself a condition of mind very far different from madness, may come at length to be productive of positive insanity, and hence we find that the principal sources of mental derangement are those influences which, so to say, seize upon and hurry away the conception, leaving at a distance, and in a debilitated, confused state, the remaining faculties and functions of the mind.

But it may be said that there are many instances of mad actions, which seem to be the result rather of ungovernable impulse, than of false conception. There is a sort of insanity, it will be urged, in which the subject of it commits actions, and expresses feelings, which he at the time knows to be immoral and irrational. Now here appears to be the stand which it behoves both the moralist and the metaphysician to make against the admission of that laxity of sentiment which goes to the destruction, not only of the land-marks of distinction between sanity and madness, but of every principle of right and wrong. 'I am aware that such an action is not consistent with the dictates of virtue, but still I am goaded on to its commission, by an absolute necessity or irresistible impulse,' is a plea that might be instituted for every sin against conscience or better feeling, and might stand as a legitimate apology for the most flagitious crimes whether public or private, selfish or social, political or moral. And, indeed, something like this defence has been set up in favor of actions which in one view of the case are acts of criminality, in another deeds of madness. Dr. Darwin gives us the following recital as an instance of insanity. Mr. ——— a gentleman of polished manners, who in a few months after destroyed himself, said to me one day, 'a ride out in the morning, and a warm parlour, and a pack of cards in the afternoon, are all that life affords,' and, as he was weary even of these enjoyments, he had determined to put an end to his existence. He was persuaded, says Dr. D., to have an issue on the top of the head, as he complained of a dull head-ache, which, being unskilfully managed, destroyed the pericranium to the size of an inch in diameter; during the time this took in healing, he was indignant about it and endured life, but soon afterwards shot himself. Now if we admit such cases as these to be cases of madness, at what point shall we cease to deplore, and

begin to condemn. Is not the distinction between virtue and vice of the most unfounded and visionary nature? and is not the implication and punishment of guilt in all instances not only cruel but absurd? Inferences like these have indeed been adduced in some recent publications of a very acute and logical cast, and they are conclusions which cannot fail of being drawn from those premises that predicate organisation as the ultimatum of every thing intellectual and moral.

But still it will be urged that many cases do often occur, and those of the most melancholy character, which both feeling and philosophy would command us to put down to the score of actual and positive irresistibility, rather than refer to a vicious and voluntary compliance with the dictates of passion. We hear often, it may be said, of most affectionate parents conceiving and actually perpetrating the murder of their offspring. The hand of the loving husband has been known to be lifted up against the wife of his bosom. The wife has sought to extinguish the life of her husband. The man marked for morality, and even distinguished for religious sentiment, sometimes plunges the dagger of destruction into his own breast. The individual noted for delicacy of conversation and correctness of conduct will, under some circumstances of disease, even revel in the dreadful luxury of loose and licentious language and demeanor.

It must indeed be allowed, that the distinction between criminality and madness in these cases of impulse, apparently beyond control, is one of especial difficulty and nicety, and requires much and very minute attention to every peculiarity and bearing of the individual case; it must, moreover, be admitted, that as it relates to the individual a correct opinion is sometimes almost impossible; and feeling of course would always point to the merciful side in dubious instances; especially as so little is in our power with respect to an accurate estimate of other interior states from external indications visible to us. In all the examples of the kind of insanity now under notice, the subject of it, during the actual commission of the act, upon the degree of criminality of which we may be called upon to decide, has verily conceived or believed himself, for the time being, to be acting according to the necessity of things; it being in his lucid intervals only that the maniac feels a consciousness of the deed that he had contemplated or executed. While the hallucination is actually upon him he believes that he is obeying imposed laws, or acting under the influence of superior mandates. But let it be recollected that nothing of this kind can be brought forward in favor of mere gusts of passion, or even of many cases of self-destruction, which last, as in the instance just cited from Darwin, are sometimes inflicted with a deliberate calculation, and dreadful venture, as to present circumstances and future states; and have, therefore, no more legitimate title to the excuse of insanity, than has the act of the gamester, who, with a dread resolve growing out of incipient despair, offers his last stake, and thus voluntarily reduces himself to wretchedness and beggary.

We repeat, however, that it is actually necessary to take into account that changes take place in the sentient part of our organisation which often are only visible in their effects, while the changes themselves are as truly physical as had they been fully demonstrated; and while we think it right, both upon moral and physical grounds, to check the extension of insanity into an unjustifiable lax degree, we should be erring still more on the other side in looking upon self-destruction indiscriminately as an immoral act. On the very day that we are penning these remarks, we have seen in the daily papers a melancholy account of suicide in one of our first poets and a most virtuous man—we speak from personal knowledge—and who does not recollect with sympathy and melancholy regard, the names of Romilly, Whitbread, and Castlereagh?

In these cases, we say, there is evidence of bodily disorganisation, or some effect beyond the mere motive of avoidable passion; and, we repeat, that in all cases of mental aberration, whether indicated by act or feeling, some change in the corporeal structure is properly presumable.

The bodily disorganisation, that we presume thus to be invariably connected with mental disease, may be primary or secondary; that is, the condition of the corporeal frame may be either such as that the common excitants shall be sufficient to occasion the derangement, or the exciting power or powers may be applied with such intensity as more positively to operate the change in question: although in this last case it may be supposed that there is, in the majority of instances, at least a predisposition thus to be affected by extraordinary excitations.

There is one fact which would go to prove, if proofs were wanting, the bodily affection in mental disease which we now contend for: and that is the remarkable and almost instantaneous mutation which is sometimes made of more obviously corporeal, for more strictly mental disorder. Take the following affecting recital from the works of Dr. Mead, in illustration of this particular:—'A young lady, about eighteen years of age, was attacked with a spitting of blood and cough, which, although active treatment was pursued, was soon succeeded by hectic fever, night perspirations, and every symptom indicative of a rapid, and menacing a confirmed, consumption. Death indeed stared her frightfully in the face. The anticipation of the event struck the patient with horror in respect of futurity, and the consequence was a state of furious mania. In the mean time her bodily condition began to amend, the fever and sweats subsided, the spitting was arrested, and every thing promised a complete recovery. From a condition of high mental agitation she now fell into melancholy; and this was in the course of three months succeeded by calmness and composure of mind; but, alas! with the return of her reason, her bodily complaints likewise returned, and this fine young creature very shortly died of actual consumption of the lungs.'

Still more remarkable however is the fact, that disorders of the body will sometimes have

effect of locking up as it were, and concealing from view the mental energies for a long series of years; and when it is asked respecting a paralysed individual where is the immortal mind which was wont to animate the features, and guide the conduct of this man, now reduced to a state of mere animal vitality, we might appeal to instances, and they are not a few, in which, just prior to the period of the total extinction of the living principle, the soul seems to come out from its hiding place, and to cast a parting glance at the surrounding scene. Who has not dwelt with agonising delight upon the transcendantly beautiful representation by Mrs. Opie, in her inimitable work entitled the Father and Daughter, where she makes the return of reason in the distracted parent to be the signal that all is about to close with him, as far as this world is concerned? and the delineation is no less true to nature than it is impressive and affecting. Not long since we heard from a respectable physician, of the Society of Friends, of an intelligent and most respected individual of that society, who had been deprived of his faculties for years by a stroke of palsy, nay, to use our friend's words, 'who had been for this long time in a state of drivelling idiotcy, but who, for some days previous to his death, was restored to the full possession of his rational powers; he summoned his astonished family around him, delivered to each of them his parting advice and benediction, and then calmly resigned himself to a peaceful death.'

In a pamphlet published some time since, by Mr. Tuke, we meet with the recital of a most singular case, bearing upon the point of that vicarious and alternate visitation of disease of the body and mind, to which we have just alluded.

'A young woman,' says Mr. T. (we extract from the Edinburgh Review), 'who was employed as a domestic servant by the father of the relater, when he was a boy, became insane, and at length sunk into a state of perfect idiotcy. In this condition she remained for many years, when she was attacked by typhus fever; and my friend, having then practised medicine for some time, attended her. He was surprised to observe, as the fever advanced, a development of the mental powers. During that period of the fever, when others were delirious, this patient was entirely rational. She recognised in the face of her medical attendant the son of her old master, whom she had known so many years before; and she related many circumstances respecting his family, and others which had happened to herself in her earlier days. But alas! it was only the gleam of reason; as the fever abated, clouds again enveloped her mind. She sunk into her former deplorable state, and remained in it till her death, which happened a few years afterwards.'

But it has been above remarked, that the accompanying bodily affection in cases of mental derangement may be secondary; that is, it may be induced by the violent action of the cause which may have induced the insanity itself. In this last case, we have moreover said that, although the excitation is from without, it is fair to presume upon some interior condition of the physical frame, different from its ordinary tone and tenor. Dr. Ferrier, it is well known, has aimed at tracing the belief in ghosts to accidental impressions, made upon the mind of the believer, under certain states of the body, which have thus proved of sufficient force to cause the belief and supposed sight of spectral images; but which, happening to impinge as it were upon this same body, under different circumstances, would have passed unheeded, or, at furthest, would have been regarded merely as the freaks and flittings of fancy. Whether this ingenious speculatist has substantiated his data to the extent contended for, we may leave to others to determine. In the mean time we will relate a case, which, although of foreign occurrence, stands already recorded in two accredited publications of our own country; and for the authenticity indeed of which, the respectability of the original narrator may be taken as a sufficient pledge.

'A student of Jena, about sixteen years of age, having a weak and irritable nervous frame, but in other respects healthy, left his apartment during twilight, and suddenly returned with a pale dismal countenance, assuring his companion that he was doomed to die in thirty-six hours, or at nine o'clock in the morning of the second day. This sudden change of a cheerful young mind naturally alarmed his friend; but no explanation was given of its cause. Every attempt at ridiculing this whimsical notion was fruitless; and he persisted in asserting that his death was certain and inevitable. A numerous circle of his fellow students soon assembled, with a view to dispel these gloomy ideas, and to convince him of his folly by arguments, satire, and mirth. He remained however unshaken in his strange conviction, being apparently inanimate in their company, and expressing his indignation at the frolics and witticisms applied to his peculiar situation. Nevertheless, it was conjectured that a calm repose during the night would produce a more favorable change in his fancy; but sleep was banished, and the approaching dissolution engrossed his attention during the nocturnal hours. Early next morning he sent for professor Hufeland, who found him engaged in making arrangements for his burial; taking an affectionate leave of his friends, and on the point of concluding a letter to his father, in which he announced the fatal catastrophe that was speedily to happen. After examining his condition of mind and body, the professor could discover no remarkable deviation from his usual state of health, except a small contracted pulse, a pale countenance, dull or drowsy eyes, and cold extremities; these symptoms, however, sufficiently indicated a general spasmodic action of the nervous system, which also exerted its influence over the mental faculties. The most serious reasoning on the subject, and all the philosophical and medical eloquence of Dr. Hufeland, had not the desired effect; and though the student admitted there might not be any ostensible cause of death discoverable, yet this very circumstance was peculiar to his case; and such was his inexorable destiny that he must die next morning, without any visible morbid symptoms,

In this dilemma, Dr. Hufeland proposed to treat him as a patient. Politeness induced the latter to accept of such offer, but he assured the physician that medicines would not operate. As no time was to be lost, there being only twenty-four hours left for his life, Dr. Hufeland deemed proper to direct such remedies as prove powerful excitants, in order to rouse the vital energy of his patient, and to relieve him from his captivated fancy. Hence he prescribed strong emetics and other medicines, and ordered blisters to be applied to both calves of his legs. Quietly submitting to the doctor's treatment, he observed that his body being already half a corpse all means of recovering it would be in vain. Indeed, Dr. Hufeland, on repeating his visit in the evening, was not a little surprised to learn that the emetic had but very little operated, and that the blisters had not even reddened the skin. The case became more serious, and the supposed victim of death began to triumph over the incredulity of the professor and his friends. Thus circumstanced, Dr. Hufeland perceived how deeply and destructively that mental spasm must have operated on the body, to produce a degree of insensibility, from which the worst consequences might be apprehended. All enquiries into the origin of this singular belief had hitherto been unsuccessful. Now only, he disclosed the secret to one of his intimate friends, namely, that on the preceding evening he had met with a white figure in the passage, which nodded to him, and in the same moment he heard a voice exclaiming, 'The day after to-morrow, at nine o'clock in the morning, thou shalt die.' He continued to settle his domestic affairs; made his will; minutely appointed his funeral; and even desired his friends to send for a clergyman, which request, however, was counteracted. Night appeared—and he began to compute the hours he had to live, till the ominous next morning. His anxiety evidently increased with the striking of every clock within hearing. Dr. Hufeland was not without apprehension, when he recollected instances in which mere imagination had produced melancholy effects; but, as every thing depended upon procrastinating or retarding that hour in which the event was predicted, and on appeasing the tempest of a perturbed imagination till reason had again obtained the ascendancy, he resolved upon the following expedient: having a complaisant patient, who refused not to take the remedies prescribed for him (because he seemed conscious of the superior agency of his mind over that of the body) Dr. Hufeland had recourse to laudanum combined with the extract of henbane; twenty drops of the former and two grains of the latter were given to the youth, with such effect, that he fell into a profound sleep, from which he did not awake till eleven o'clock on the next morning. Thus the prognosticated fatal hour elapsed; and his friends waiting to welcome the bashful patient, who had agreeably disappointed them, turned the whole affair into ridicule. The first question, however, after recovering from his artificial sleep, was 'What is the hour of the morning?' On being informed that his presages had not been verified by experience, he assured the company that all these transactions appeared to him as a dream. After that time he long enjoyed a good state of health, and was completely cured of a morbid imagination.'

This very curious example of the influence of the imagination upon both the mental and bodily condition of being, may be considered as instructively interesting in several points of view. In the first place the possibility is established of a bodily affection originating in a mental cause; and it forms, therefore, an insuperable obstacle to the admission of that postulatum which demands that every thing which we are accustomed to consider and to call mind be placed to the account of organic operation as its source. Without the addition or subtraction of a particle of matter to the frame, actual disease, we see, may both be induced and suspended; and, if the presumed predisposition to fall into such disease be admitted as evidence of organisation having to do with the effect, this kind of argument ceases to be applicable to the point of the disorder's cessation, which it will have been remarked took place with the rapidity of a charm, when the prevailing fancy upon which it depended was proved to the patient to have no foundation in fact.

In the second place, the example just adduced may serve to show the impropriety of opposing with the weapons of reason or ridicule those fantasies, and feelings, and convictions, which however ungrounded in the abstract, and in fact, have nevertheless a certain sort of truth in them as it refers to the individual influenced. Prove, if you can, and as professor Hufeland by a dexterous ruse in the present instance did, that maniacal illusions are illusions; but never attempt to convince a madman, or even a nervous invalid, against the evidence of his own senses and feelings.

Lastly, it may be observed that the fulfilment of alleged predictions in respect to events supposed to be communicated in a supernatural way, by no means proves the verity of these pretensions, since the conceptions themselves may come to operate the circumstance predicted, and thus a mere physical incident would be apt, by the generality of judges respecting events of this nature, to be set down as a visitation from the world of shadows. The much-talked of death of the late lord Lyttleton, for example, is sufficiently accounted for by mental and physical causes, without looking for its explanation to an especial interference of divine providence. The Horatian maxim in respect of poetry, not to introduce superior agency unless the occasion obviously demands it, is especially applicable when philosophy is concerned; and, while we reject the sceptical tenets of necessity as conducting to error in principle and mischief in effect, let us as carefully close our ears against the calls of superstitious credulity to enlist ourselves under her blood-stained banners.

We may be permitted to add a few words more on the sources and preventives of nervous affections: of nervous affections, we say; for, inconsistent as at first sight it may seem with the limitations proposed respecting the essentials of insanity, we would express it as our conviction

that there is a certain kind of truth in the strongly expressed axiom of a modern author, that 'every nervous disease is a degree of insanity;' in other words, when fancies are substituted for realities, absolute sanity can never be predicated: there is a certain degree of delusion present, or a belief in the existence of things that have no other entity than in the mind of the recipient and sufferer.

Let us again be indulged while briefly illustrating our meaning by examples. Two individuals shall be on the bed of sickness, both of whom shall complain of an equal degree, although of a different kind of disorder, and the complaint shall virtually for the time be of the same measure in either; but in this consists the difference that the illness of the one is positive—of the other, so to say, negative; or, in other words, the loss of power will be only susceptible of very gradual restoration by the due employment of physical agents in the first; while the latter, though apparently equally feeble and helpless, only requires the proper kind of stimulus to be applied, and the complaint will immediately disappear as if charmed away by the power of magic. After what has been stated, in a preceding part of the present paper, it will not surely be suspected that we mean to insinuate there is not actually a bodily disorder in the one case as well as in the other; all that we wish to infer is the difference of the two states supposed; the one being frequently vincible by mere mental excitants, the other necessarily under the control only of physical agents.

Dr. Reid, in his treatise on Nervous Ailments, has given the history of a very instructive case, under the title of Real Evils a Remedy for those of the Imagination. This, with a very curious but well-authenticated case from Dr. Mead, we shall in the first place take the liberty of laying before our readers, and then add a few observations on the practical advantages which might be made of such occurrences.

'Some years ago,' says Dr. R., 'I knew a lady who had been for a long time a miserable victim to the vapors, but who was completely cured of this complaint by the supervening of another, which was more immediately alarming, and which precluded indeed the possibility of much longer life. No sooner was her new disease ascertained to be an aneurism of the aorta, and the necessary result of that complaint was explained to her, than all her nervous feelings vanished; and she even bore the announcement of her inevitable fate with a calmness which is seldom exhibited under such trying circumstances. The near prospect of death, instead of overpowering, seemed to brace anew the relaxed energies of her frame; and, what is worthy of remark, so far from being during her subsequent days, selfishly absorbed by her real, as she had before been by her imaginary ailments, she interested herself almost continually and exclusively about the happiness of others; and in proportion as she became more amiable she became less wretched.'

The case of Dr. Mead is as follows:—'An academic became so deeply imbued with imaginary fears respecting his health, that, after having taken to his bed for some time, he at length insisted that he was actually dying, and ordered the passing bell of the church which was contiguous to his house, to be tolled for his departure. It was in a catholic country. He had been himself accustomed when a young man, for the sake of exercise, to ring this same bell, and by this practice having acquired a connoisseurship in the art of tolling, he found himself displeased with the manner in which the present performer executed his task; and, thus irritated with the man's bungling, he sprang out of bed, and with his own hands showed him the manner in which he would have it done. He then returned to his bed bathed in perspiration, and was ever afterwards free from complaint. Vitam autem reddidit iste labor et convaluit.'

Now, although it is not very often that the actual distinction between nervous and other complaints shows itself in so marked a manner as in the above recitals, yet common and every day occurrences are degrees of the same evidence; and these more conspicuous instances of actual capacity, combined with imaginary inability, might be made to serve, if properly applied, a very useful purpose.

A combination, it will be allowed, of mental and physical impulses, is for the most part operative in the production of every grade of mental and nervous derangement; and thus we have it sufficiently explained why these derangements become more numerous in proportion as we recede from simple and rustic, and advance to social and refined habits. Every augmentation of our enjoyment supposes, by a law of nature, an increased susceptibility to suffering; and when the surface of impression is thus constantly, as it were, beaten out into increased expansion, by the multiplication and successively new conjunction of existing agents, it is not surprising that life thus rendered more artificial and more complicated, becomes in the same ratio more obnoxious to disgusts and derangements. It is a remarkable fact, that in savage life even intense passions, such as love and religious fervor, do not operate as they do with us, a deterioration of the understanding beyond mere fallacy of judgment, and consequently irrational conduct in immediate reference to the subject of the prevailing sentiment. And why is this? Palpably because the movements of the mental and bodily frames of the savage are, so to say, regulated by less complicated machinery, and therefore less likely to be irregularly excited. 'In proportion,' says an eloquent writer, 'as man emerges from his primeval state do the furies advance upon him, and would seem to scourge him back into the paths of nature and simplicity.'

Having thus briefly discussed the question respecting the essentials and sources of insanity, we now proceed to treat the subject somewhat more medicinally, and shall consider the history, prognosis, and treatment of madness, upon the plan which we have generally pursued in the present article.

Symptoms.—'The coming on of madness is marked,' says Haslam, 'by restlessness. Insane patients first become uneasy and incapable of confining their attention; they neglect their accustomed employment; they get but little sleep

they are loquacious and positive on any subject that may be started; soon after they are divested of all restraint in their declaration of their opinion of those with whom they are acquainted; their friendships are expressed with fervency and extravagance; their enmities with intolerance and disgust. They now become impatient of contradiction, and scorn reproof. For supposed injuries they are inclined to quarrel and fight with all about them. They have all the appearance of persons inebriated, and people unacquainted with the symptoms of approaching mania, generally suppose them to be in a state of intoxication. At length suspicion creeps into the mind, they are aware of plots which had never been contrived, and detect motives which were never entertained. All this may exist without the perceptions and associations being sufficiently disturbed to constitute actual madness; at last, however, the succession of ideas becomes too rapid to be examined; the mind becomes crowded with thoughts, and indiscriminately jumbles them together: insanity is established. Patients under the influence of the depressing passions will exhibit a different train of symptoms. The countenance wears an anxious and gloomy aspect; they retire from the company of those with whom they had formerly associated, seclude themselves in obscure places, or lie in bed the greatest part of their time. They next become fearful; and, when irregular combinations of ideas have taken place, conceive a thousand fancies, often recur to some former immoral act which they have committed, or imagine themselves guilty of crimes they never perpetrated; believe that God has abandoned them, and with trembling await his punishment. Frequently they become desperate, and endeavour with their own hands to terminate an existence which appears to be an afflicting and hateful incumbrance.'

Causes.—The causes of insanity are numerous, and the predisposition to run into the insane state is very often indeed connate; although this fact has been attempted to be denied or explained away by several modern authors—as by Brown, Adams, Hill. The hereditary nature of the complaint is not however so absolute and unnecessary as has been, on the contrary, conceived by others; and much family apprehension is often established upon a false foundation in reference to this particular. The exciting causes of madness are physical, mental, and moral; such as inebriety, pride, and the feelings and emotions of whatever nature and kind are calculated in their indulgence to derange the intellect; but the very passions and emotions themselves prove that the business is half accomplished before the specific excitation has been applied. Madness sometimes makes its way into the system through the medium of other more decidedly corporeal complaints; and sometimes, as we have seen, it in a manner dislodges and supersedes these; and it often comes upon a person without any obvious reason either of predisposition or excitement.

The mental causes adduced by Arnold are intense application to business, or study; passions of various kinds; too great activity of imagination, and imbecility. His enumeration of bodily causes is—internal, seated in the brain; external, acting mechanically on the brain. Causes acting on the body generally, and through it upon the brain, either directly, sympathetically, or by translation.

Distinctions.—A great deal has been said of the necessity of distinguishing between melancholia and mania; but these distinctions are scarcely traceable, inasmuch as the fury of maniacal excitement very often passes into the abstraction of melancholy; and in this case, as in other disordered manifestations, we must be careful of not giving rise to the idea of any essential or abstract difference in the essence of disease, merely by inventing terms. Hypochondriacism, or that state which is as it were between sanity and insanity, the completely absorbed state of the melancholic, and the high ravings of the maniac, will be manifested by the same individual. And, as far as bodily and mental disorder must be considered as establishing a distinction, we have already more than once said that the most purely mental affection must in one sense be corporeal, that is, it must be attended with some change in the bodily condition, whether that change be visibly structural, or only cognizable in its effects. When indeed the functions of the stomach are obviously deranged, and such derangement obviously regulates the mental aberrations, the word hypochondriasis may, if you please, apply in the way of distinction from melancholia, which often commences, pursues its course, and becomes confirmed into complete insanity, without appearing to have any thing to do with chylopoietic conditions.

Prognosis.—With regard to prognosis, Dr. Cox, who enjoys ample opportunities for minute observation, tells us that the chances of recovery are against those madmen in whom the disposition can be traced to lunatic ancestry. 'When the causes are manifestly corporeal, a favorable termination may be expected. When the subjects of hallucination vary, and the mind is not obstinately fixed on one topic, hopes may be indulged. The insanity subsequent to parturition is generally curable, if the curative attempts be rational, which is not always the case.' It deserves, however, to be noticed, that the intellect in this case is subject to a second derangement from the same exciting sources, just as abortion has a tendency to recur after it has once happened. 'Palsy, hemiplegia, and diseases of this class supervening, may be reckoned among the unfavorable occurrences.' In these cases the unhappy patient often becomes decidedly, and beyond recovery, fatuitous. 'Patients,' says Haslam, 'who are in a furious state, recover in a larger proportion than those who are depressed and melancholy.' When the furious state is succeeded by depression, and after this shall have continued a short time the violent paroxysm returns, the hope of recovery is very slight. Indeed, whenever these states of the disease frequently change, such alternations may be considered unfavorable.'

Dr. Darwin well observes that, 'when an individual becomes insane who has a small family of children to solicit his attention, the prognosis is very unfavorable, as it shows the maniacal hallucination to be more powerful than those ideas

which usually interest us most.' And Haslam further states, 'that in those instances where insanity has been produced by a train of unavoidable misfortunes, as when a father of a large family, with the most laborious exertions ineffectually struggles to maintain it, the number who recover is very small.' It may be added that, in proportion to the length of time the malady may have lasted, is the hope enfeebled of ultimate recovery. After the disorder has lasted for more than a year, the chances against restoration are great.

The statements of proportionate recoveries from insanity show much discrepancy. The most favorable we have seen is that of Dr. Burrows, who remarks that, if curative attempts are pursued with judgment, eighty-one cases out of 100 may be expected to recover. Of quite recent ones ninety-one in 100; and of old cases thirty-five in 100.

In respect to appearances of the brain, of the liver, and other viscera, when examined after death, there are scarcely any kind of morbid changes which have not at different times been seen; but no certainty of inference has yet been deducible from these appearances, inasmuch as they are by no means regularly conformable with what might, à priori, be expected from analogy, and from the witnessing of other cases. The very same appearances, it has been remarked, have exhibited themselves after the most opposite disorders; and Haslam expressly states, that even the general texture of the brain of maniacs, independently of partial lesions, shows an unnatural firmness, or morbid flaccidity, without any apparent reason why it should be so. Dr. Arnold has been at the pains of collecting from Bonetus, Morgagni, and Haller, their several statements of organic lesion, as of hardened and thickened membranes, turgidity of blood-vessels, water in the ventricles, different conditions of the pineal gland, bloody spots in different parts of the brain itself, purulent matter in its substance or ventricles, enlarged plexus choroides, dilated carotids and jugulars, dryness and hardness, or softness of its texture, adhesions of the dura mater to the frontal bone, and many other conditions of the brain itself, and accompanying disorganisation of the abdominal, and even thoracic, viscera; and although it is inferred, from a collation of all this evidence, that in disorders of the mind the brain and its connexions are usually affected, yet it is at the same time allowed that nothing of regularity obtains; and it is further uncertain how much that is seen has been cause, and how much consequence. It behoves us farther to say, in reference to morbid appearances, that the phrenological pathologists are pursuing the investigation, under the assumption that the multifarious kinds and characters of mental derangement are explicable upon the particular portion of the brain that shall have been affected. Thus excitation and delusion on one particular point, may be supposed especially to implicate that part of the encephalon which is occupied in the development of the particular passion or sentiment affected. Should future investigations confirm this principle, a great deal of what has been hitherto considered anomalies and inexplicable may be expected to be unfolded. And we think it right here to state, that one of the medical officers of a public institution for the insane has told us, that his observations harmonise with the tenets of those physiologists to whom we now allude.

Treatment.—In regard to the treatment of the insane, it should ever be preserved in recollection that an important distinction obtains between high excitement of the mind and augmented vascular action. Natural enough it is to conclude, that, in cases where we are called upon to witness the ravings of maniacal fury, a large detraction of blood from the vessels of the head is the solum remedium, the obvious and only resource. It is possible, however, for a state of the most dreadful irritation and excitement of a maniacal kind to exist and be expressed, without the blood-vessels being at all brought into that kind of state which would seem to demand bleeding, and where bleeding, indeed, will be likely to rivet and protract, rather than to mitigate and shorten, the course of the malady. It is a remarkable fact that the blood of a furious maniac for the most part exhibits, when drawn from its vessels, a state very different from that of inflammation; there is often not the smallest vestige of inflammatory buff; and it is in these cases that bleeding often does much more harm than good. We would by no means wish to assert that we consider that proposition as of universal application which objects to venæsection in mania, but we do at the very best think it problematical whether had the practice never been had recourse to, even in any one single instance, there would not have been less mischief occasioned than has been produced by its injudicious and erroneous employment. Blood-letting is principally indicated when the malady has been evidently induced through the medium of some bodily disorder; as when the catamenia have suddenly ceased after parturition, and mania has immediately succeeded; when there is much hardness, and evident velocity, about the pulsations, it is sometimes necessary to take blood, either from the head by leeches, from the neck by cupping, or from the arm by venæsection: and this demand is more especially imperious when the vascular irritation has obviously existed prior to the mental excitement.

Purging may be considered a practice of much more unequivocal and general admission than that of sanguineous depletion. With that fashionable theory we do not accord which attributes all maniacal derangement to visceral torpor and obstruction; but these obstructed states must undoubtedly have an occasional and very material influence upon the state of the mind; and such is the connexion and sympathy between the brain and stomach, that this organ and its connected viscera very often, indeed, come to be affected, in consequence of the encephalic derangement, in such a way as to render obvious the necessity of intestinal evacuations. It is impossible to lay down any rules with regard to the mode of administering purgatives which shall apply to all cases. Suffice it to say, that the saline and antiphlogistic remedies of this class seem especially indicated when much vascular irritation accompanies the maniacal derange-

ment; and that, when the hallucination is rather connected with torpor in the stomach, the vessels, and the general system, drastic cathartics are more particularly called for. Calomel is sometimes given in connexion or alternation with aloetic medicines with much benefit. But it is not possible to lay down any more than very general rules to be acted upon by the experience and good sense of the prescriber. Suffice it then to say, it is not merely a recognition of the principle that purgatives are useful, which ought to regulate the practice in these cases; but the practitioner ought to be aware of the necessity of combining, alternating, suspending, increasing, and diminishing the kinds and doses of these medicinals with an attention very different from that of mere empirical routine.

Warm bathing is another remedial process sometimes abundantly applicable and of signal utility. Attention to the cutaneous discharge is an important principle in the treatment of mental disorders; and it is in a great measure by increasing and regulating this discharge, that the practice of warm bathing proves beneficially operative.

A practice at least as old as Celsus has recently been revived under the assumption of novelty, and has been lauded as highly efficacious; it is that of causing the insane person to sit in a hot-bath with the water up to his neck and pouring cold water from a height on his naked head while in the bath.

Of the various medicinals of the nervous class we confess a considerable degree of scepticism. Camphor, opium, henbane, foxglove, nightshade, have all been lauded and derided in their turns, as they have been employed by different physicians and under different circumstances. In those cases of temporary insanity, as connected with bodily disease, in which we have found it necessary to empty the blood vessels, the immediate administration of pretty considerable doses of opium has appeared to us to be of vast advantage; but we must confess the experience we have had of any other medicinals, of the above stated kind, has not been satisfactory as to their respective virtues. In the supplementary report of the state of receptacles for the insane, there is a remarkable and well attested account of the very great powers of digitalis in calming the fury of a maniac; and an author of practical eminence delivers his opinion of this medicine in the following terms:—'Where the derangement is accompanied, and in a degree regulated, by an accelerated circulation without any other symptom of pyrexia, I have found foxglove extremely applicable. Indeed, says Dr. Cox (the author to whom we allude), I am of opinion that no case ought to be abandoned as incurable, till it has been submitted to a trial of this powerful medicine. I had a patient (he says) whose system was kept saturated as it were by digitalis for weeks in succession, whose mental wanderings seemed regulated by the state of his pulse; when the pulse was at ninety he was constantly furious, at seventy perfectly rational, at fifty melancholy, and at forty half dead. This man was at length perfectly cured by such a dose of this remedy as kept the pulse pretty uniformly about seventy.

Partly upon the same principles with digitalis, Dr. Darwin has recommended, and Dr. Cox extensively employed, rotatory motion to the extent of inducing vertigo and nausea. Haslam ridicules this practice. We repeat that all these expedients are at the best but of questionable utility. Mr. Hill, in his treatise on insanity, speaks in very high terms of emetics, especially of those composed of equal parts of tartarised antimony and sulphate of copper, according to the formula of Marryatt; and he orders these to be given every third morning for weeks together. There is so much appearance of practical good sense about Mr. Hill's book that we should be disposed to listen with some attention to any of his suggestions; but we should incline rather to the purgative than the emetic practice; always, however, recollecting the propriety of the tonic plan of treatment in connexion with purging, when a decidedly asthenic state of the system is present.

A few words remain to be said on the moral management of madness. To reason with a madman is said to prove ourselves in the same predicament with our patient. By a judicious and skilful management, reason, however, has sometimes been recalled from its wanderings, and replaced in its appropriate seat. M. Pinel, in his late work on Mental Derangement, records a curious instance of the cure of insanity, which is by no means destitute of instruction. In the Bicetre of Paris one of the lunatics supposed that his head had been taken off by the guillotine and that a new one had been fixed on his shoulders; a convalescent from lunacy conversing with this individual artfully turned the conversation upon the miracle of St. Dennis, who was said to carry his head under his shoulders and kiss it as he walked along. The insane individual appealed to his own case in order to prove the possibility of the fact, when the narrator of the story with a burst of laughter suddenly exclaimed, why how you fool could St. Dennis kiss his own head? was it with his heel you blockhead? Pinel states that this difficulty starting upon the mind of the deranged man actually operated his recovery.

Another mode in which maniacal hallucination has been dispelled, is that of indulging the sufferer in his erroneous conceptions, as in the following case related by Boerhaave.—'A counsellor at Paris retained his urine lest he should deluge the city, till his friends raised a cry of fire, and prevailed on him to lend them his assistance towards extinguishing the flames.' Vanswieten mentions the case of a man who conceived that his legs were made of glass, till the maid servant threw a block of wood upon his shins, which excited pain, and with it such indignation, that, forgetting the transmutation of his limbs, he pursued her to take revenge. Thus convinced the conceit left him, and, by proper exercise, he perfectly recovered.

The following case is from Dr. Cox, and similar cases in kind, if not in degree, are falling daily into the hands of the medical practitioner The use which may be made of them is this; that by a justifiable acquiescence in the reality of alleged feelings, the physician may oftentimes be more successful in dispelling such hallucina-

tions, than by endeavouring the hopeless task of convincing his patient of the mere imaginary nature of his sufferings. 'Mr. ———, aged twenty-five, of a fair complexion, though dark hair and eyes, of exemplary morals and most amiable manners, was fond of anatomy, and had dissected some few animals; very desultory in his studies, but had read some medical authors with much attention, and was in the constant practice of quacking himself. Though no apparent alteration took place in his countenance, yet he constantly complained; and all his attention was confined to his health, which at length actually rendered him incapable of any exertion, either bodily or mental. After the repeated and anxious enquiries of his friends, it was discovered he believed himself affected with syphilis, contracted not by any unfortunate connexion, but from sitting on the same seat with an infected person. Deaf to all reasoning and attempts to prove the impossibility of the disease being propagated in such a way, his case was referred to some medical man of whom he had read or heard; and he, being previously instructed, pronounced it venereal, sent a prescription which very soon dissipated the absurd idea, and restored him to himself, his friends, and his family.'

To revive former impressions, and thus to break the chain of diseased association, will sometimes be an advisable attempt. On this account, and with this view, it will of course be important to ascertain the previous habits, tastes, feelings, propensities, and occupations of your insane patient. 'In a military maniac,' says a modern author of much acumen, 'I once witnessed the notes of a shrill pipe managed with some address first awaken the attention, then occasion interest, as was obvious by his animated looks, and beating time; at length, by varying the air according to the observed effects, produce the most pleasing sensations. It at length brought back some very impressive recollections, created entirely new trains of thought, and seemed to correct the errors of intellect. Though he had not left his bed for weeks, nor spoken a single word during that time, and had been supported entirely by force, he now arose, dressed himself, and without any other remedy but gentle tonics, returned to his former habits of neatness and rationality; advancing gradually to perfect recovery.'

But we might occupy a great number of pages were we to go over the records of individual cases, in which either by design, or by accident, a forcible impression upon the imagination or feelings of maniacs, had succeeded in dispelling the deranged idea, either for a time or for a continuance. The reader is not to suppose that we mean to assert that this task of curing insanity, by these means, is of easy accomplishment; but it is always right of course to be armed at all points, and to make accidental occurrences subservient to practical instruction.

With regard to the question of confinement, and personal restraint, it is difficult to say any thing which shall apply universally. Certain it is, as a modern author has stated, that nothing is more calculated to make a man mad, than the idea that he is thought so by others; on the other hand, however, we feel convinced that incipient insanity has often been prevented from breaking out into overt acts, and from becoming confirmed and irremediable, by an early and judicious personal restraint. We recollect hearing Dr. Aikin say, that some of the most valuable articles in his biography were penned in a mad house, and that the gentleman who wrote them was so convinced himself of the necessity of his own confinement, that when he found himself conscious of approaching insanity he voluntarily submitted himself to the custody of keepers, and the regime of a mad-house, before the malady had come to such a height as to deprive him of the power thus to exercise his will. We must confess, for ourselves, that in the generality of cases in which we found the marks of insanity pretty fairly made out, even before the malady should have become thoroughly established, we should rather incline to give our probatum for placing the individual under those circumstances which would prevent the possibility of his inflicting injury either upon himself or others; and which, we are convinced, although it may bear the appearance of cruelty, is often, on the contrary, the height of mercy. We do not say that we would consign every nervous or melancholic man to the stigma of madness and the confines of a mad-house; nor, we hope, is it at all necessary for us to say, that every thing in the shape of restraint or control, beyond what is necessary to the well-being both of the patient and those about him, is to be deprecated as equally absurd and inhuman. 'It has been recommended,' says an author to whom we have more than once referred in the present paper, 'by very high authority, to inflict corporal punishment upon maniacs with a view of rendering them rational by the impression of terror; what success may have followed such disgraceful and inhuman treatment, I have not yet learned, nor should I be desirous of meeting with any one who could give me the information. If the patient be so far deprived of understanding as to be insensible why is he punished? such coercion, setting aside its cruelty, is manifestly absurd; and, if his state be such as to be conscious of the impropriety of his conduct, there are other methods more mild and effectual.'

411. *Night Mare.* Oneirodynia.—It is rather curious that Dr. Cullen should have classed this affection under the head of vesanic disorders, which is only thus entitled to a situation among these ailments from the circumstance of the imagination being morbidly excited in them. The oneirodynia of nosologists is divided into active and passive; in the first the irritative and imaginative ideas excite the patient to walk in his sleep; the second is characterised by a sense of oppression upon the breast, as if a heavy load were lying upon and threatening the individual with suffocation.

Dr. Darwin in his Zoonomia introduces the following ingenious observations on the subject of sleep, which were transmitted to him in a letter from Dr. Currie; and we shall here transcribe them with the comments of Dr. Darwin, and the further remarks of the latter on the subject of night mare.

'Though rest in general perhaps renders the healthy pulse slower, yet, under certain circumstances, the contrary is the truth. A full meal without wine, or other strong liquors, does not increase the frequency of my pulse, while I sit upright, and have my attention engaged. But if I take a recumbent posture after eating, my pulse becomes more frequent, especially if my mind be vacant, and I become drowsy; and, if I slumber, this increased frequency is more considerable with heat and flushing.

This I apprehend to be a general truth. The observation may be frequently made upon children; and the restless and feverish nights experienced by many people after a full supper are, I believe, owing to this cause. The supper occasions no inconvenience whilst the person is upright and awake; but when he lies down and begins to sleep, especially if he does not perspire, the symptoms above mentioned occur. Which may be thus explained in part from your principles. When the power of volition is abolished the other sensorial actions are increased. In ordinary sleep this does not occasion increased frequency of the pulse; but, where sleep takes place during the process of digestion, the digestion itself goes on with increased rapidity. Heat is excited in the system faster than it is expended; and, operating on the sensitive actions, it carries them beyond the limitation of pleasure, producing, as is common in such cases, increased frequency of pulse.

It is to be observed that, in speaking of the heat generated under these circumstances, I do not allude to any chemical evolution of heat from the food in the process of digestion. I doubt if this takes place to any considerable degree; for I do not observe that the parts incumbent on the stomach are increased in heat during the most hurried digestion. It is on some parts of the surface, but more particularly on the extremities of the body, that the increased heat excited by digestion appears, and the heat thus produced arises, as it should seem, from the sympathy between the stomach and the vessels of the skin. The parts most affected are the palms of the hands and the soles of the feet. Even there the thermometer seldom rises above 97° or 98°, a temperature not higher than that of the trunk of the body; but three or four degrees higher than the common temperature of these parts, and therefore producing an uneasy sensation of heat, a sensation increased by the great sensibility of the parts affected.

That the increased heat excited by digestion in sleep is the cause of the accompanying fever, seems to be confirmed by observing that, if an increased expenditure of heat accompanies the increased generation of it (as when perspiration on the extremities or surface attends this kind of sleep), the frequent pulse and flushed countenance do not occur, as I know by experiment. If, during the feverish sleep already mentioned, I am awakened, and my attention engaged powerfully, my pulse becomes almost immediately slower, and the fever gradually subsides.'

From these observations of Dr. Currie it appears, that, while in common sleep the actions of the heart, arteries, and capillaries, are strengthened by the accumulation of sensorial power during the suspension of voluntary action, and the pulse in consequence becomes fuller and slower; in the feverish sleep above described the actions of the heart, arteries, and capillaries, are quickened, as well as strengthened, by their consent with the increased actions of the stomach, as well as by the stimulus of the new chyle introduced into the circulation. For the stomach, and all other parts of the system, being more sensible and more irritable during sleep, and probably more ready to act from association, are now exerted with greater velocity, as well as strength, constituting a temporary fever of the sensitive irritated kind, resembling the fever excited by wine in the beginning of intoxication; or in some people by a full meal in their waking hours.

On waking, this increased sensibility and irritability of the system ceases by the renewed exertions of volition; in the same manner as more violent exertions of volition destroy greater pains; and the pulse in consequence subsides along with the increase of heat. If more violent efforts of volition are exerted, the system becomes still less affected by sensation or irritation. Hence the fever and vertigo of intoxication are lessened by intense thinking; and insane people are known to bear the pain of cold and hunger better than others; and, lastly, if greater voluntary efforts exist, as in violent anger or violent exercise, the whole system is thrown into more energetic action, and a voluntary fever is induced, as appears by the red skin, quickened pulse, and increase of heat; whence dropsies and fevers with debility are not unfrequently removed by insanity.

Hence the exertion of the voluntary power in its natural degree diminishes the increased sensibility, and irritability, and probably the increased associability, which occur during sleep; and thus reduces the frequency of the pulse in the feverish sleep after a full meal. In its more powerful state of exertion it diminishes or destroys sensations and irritations, which are stronger than natural, as in intoxication, or which precede convulsions, or insanity. In its still more powerful degree the superabundance of this sensorial power actuates and invigorates the whole moving system, giving strength and frequency to the pulse, and a universal glow both of color and of heat, as in violent anger, or outrageous insanities.

If, in the feverish sleep above described, the skin becomes cooled by the evaporation of much perspirable matter, or by the application of cooler air or thinner clothes, the actions of the cutaneous capillaries are lessened by defect of the stimulus of heat, which counteracts the increase of sensibility during sleep, and the pulsations of the heart and arteries become slower from the lessened stimulus of the particles of blood thus cooled in the cutaneous and pulmonary vessels. Hence the admission of cold air, or ablution with subtepid or with cold water, in fevers with hot skin, whether they be attended with arterial strength or arterial debility, renders the pulse slower; in the former case by

diminishing the stimulus of the blood, and in the latter by lessening the expenditure of sensorial power.

The night-mare is an imperfect sleep, where the desire of locomotion is vehement, but the muscles do not obey the will; it is attended with great uneasiness, a sense of suffocation, and frequently with fear. It is caused by violent fatigue, or drunkenness, or indigestible food, or lying on the back, or perhaps from many other kinds of uneasiness in our sleep, which may originate either from the body or mind.

Now, as the action of respiration is partly voluntary, this complaint may be owing to the irritability of the system being too small to carry on the circulation of the blood through the lungs during sleep, when the voluntary power is suspended. Whence the blood may accumulate in them, and a painful oppression supervene; as in some hæmorrhages of the lungs, which occur during sleep; and in patients much debilitated by fevers.

Great fatigue with a full supper and much wine, I have been well informed by one patient, always produced this disease in himself to a great degree. Now the general irritability of the system is much decreased by fatigue, as it exhausts the sensorial power; and, secondly, too much wine and stimulating food will again diminish the irritability of some parts of the system, by employing a part of the sensorial power, which is already too small, in digesting a great quantity of aliment; and in increasing the motions of the organs of sense in consequence of some degree of intoxication, whence difficulty of breathing may occur from the inirritability of the lungs.

This explains an apparent paradox, why people who are feeble digest their dinners best if they lie down and sleep, as most animals do, when their stomachs are full. Yet many weak people sleep very uneasily after a large supper. If the debility of the patient be not very great, and the dinner he has taken be moderate, the suspension of voluntary action during sleep prevents the expenditure of so much sensorial power, which may be employed on the actions of the stomach, and thus facilitate the digestive process. If the patient be further exhausted as in the evening, or his debility greater, and sleep ensues after a copious or stimulating supper, so much sensorial power will be exerted on the actions of the stomach for digestion, that the circulation of the blood through the lungs will be impeded from the diminished irritability to external stimuli, and the absence of volition, as in the incubus, and somnus interruptus.

M.M. To sleep on a hard bed with the head raised. Moderate supper. The bark. By sleeping on a harder bed the patient will turn himself more frequently, and not be liable to sleep too profoundly, or lie too long in one posture. To be awakened frequently by an alarm clock.'

The cause of sleep walking or active oneirodynia, is exceedingly obscure. An ingenious essay published some time since (if we recollect right, in one of the volumes of Transactions from the Dublin College of Physicians) endeavoured to establish the phrenological datum of separate faculties and localities of the brain from the phenomena presented by the sleep walker; the doctrine advocated in the paper was this, that the waking condition of one part of the cerebral mass in connexion with the torpid state of the others impels to sleep walking from the circumstance of those faculties being still locked in sleep which if awake would correct the impulse of the one awake and put it under the ordinary control of regular condition.

One very remarkable feature in sleep walking is the accuracy with which things are accomplished, demonstrably without the exercise of those perceptions which we are accustomed to think absolutely necessary to be in exercise for the accomplishment of the purposes effected; it would seem as if the whole sentient power were for a time accumulated in one organ, and that thus a person, by becoming all ear or all touch, made up as it were for the want of other senses. We know, indeed, that this law in some measure obtains under circumstances of permanent suspension or abolition of one of the senses; the nervous power which would have been expended in the exercise of this or of that sense is directed into one which still remains unimpaired, and the latter becomes in the same ratio acute; thus magnitude and form are judged of by a blind man, through the organ of hearing, and an individual being without, or having lost, his sight is often able to determine the number of persons present in a room, merely by the acuteness of smell. Habit and exercise we are aware explain a good deal of this law, but they do not wholly; and the sleep walker, as we above intimated, appears to illustrate it in a remarkable manner. As a matter of curiosity, and with a view to exemplify the above positions, we shall extract the following interesting accounts which Dr. Beddoes has copied in his Hygëia from foreign publications; and remarkable, or inexplicable as they appear, they are too well authenticated to allow us to doubt of their truth.

'In the Encyclopedie, under the article SOMNAMBULE, there is an observation which shows a remarkable suspension of one series of affections, while others, the most intimately connected with them, were going on. The archbishop of Bourdeaux was at college with a student subject to walking in his sleep. On planting himself from curiosity in the student's chamber, so as to ascertain his motions, he observed the young man sit down to compose sermons, which he read page by page as he committed them to paper, if it can be called reading when no use was made of the eyes. On being dissatisfied with any passage, during the recitation, he crossed it out and wrote the correction with much accuracy over it. The writer of the article saw the beginning of a sermon in which was the following amendment. It stood at first ce divin enfant. On revisal it struck the student to substitute adorable for divin. So he struck out the former word, and set the latter exactly above it. But, remarking that the article ce could not stand before adorable, he very nicely set a *t* after ce, and it then stood, cet adorable enfant.

To satisfy himself that the somnambulist, in all these operations, made no use of his eyes, the archbishop held something under his chin, suffi-

cient to intercept the view of the paper on which he wrote. But he wrote on without being interrupted by this obstacle in the way of his sight. To discover how the night-walker knew the presence of objects, the archbishop took away the paper on which he wrote and pushed other papers under his hand. Whenever they were of unequal size the student was aware of the change; but, when they were equal, he wrote on, and made corrections on the spots corresponding with his own paper. And it was in this way that possession was gained of some of his nocturnal lucubrations. Among other manuscripts, which the archbishop put into the hand of the encyclopædist, are musical pieces written with tolerable exactness.

One night, having dreamed that he was beside a river into which a child had fallen, he went through all the actions tending to its rescue, and with teeth chattering, as from cold, asked for brandy. None being at hand, a glass of water was given him instead. But he immediately remarked the difference, and with greater impatience demanded brandy, saying he should die if none were given him. Brandy was therefore now brought. He took it with pleasure, and said, as he smelled to it, that he found himself already better. All this time he did not awake, but, as soon as the paroxysm was over, lay down on his bed and slept very composedly.

In some cases the susceptibility of visual impressions has undoubtedly remained, because the somnambulist has been sensible to some present objects of sight, though not to others. This partial attention seems clearly to have existed in the case described in Darwin's Zoonomia, since the patient drank tea, when it was set before her, and smelt to a tuberose, which last action might however have arisen from accurate recollection of the place where it stood. In the remarkable instance, frequently observed and described at large by Porati, the same circumstance occurred. A young man in his employ, of the name of Castelli, who had often before suffered from nervous affections, took a candle and lighted it. Instead of going to bed, as was supposed to be his intention, he went down stairs, reached a book from a shelf in his master's study, and began to read. Porati several times desired him to go to bed, but received no answer, upon which he took away the light. Castelli upon this got up, and opened the window, observing—it is cloudy, we shall have rain to day. The master now replaced the light, and Castelli immediately walked up to it, and began to read aloud. The people of the house collected round him, but he observed no one. They called to him, but he did not hear. The light being again removed, he got up, rubbed his eyes, and said 'I am not well; I must go out into the air.' He accordingly went into the apothecary's shop belonging to his master. Here, other methods having been fruitlessly tried to rouse him, some spirit of hartshorn was held to his nostrils, when he immediately sank to the floor and fell into convulsions. After some minutes he had a tetanus, or universal spasm of his muscles, which by degrees relaxed, and he slept. Presently he awaked, as out of a sound sleep, but knew nothing of what had passed.

Another time he fell asleep in the shop, but had continued only a short time in that state, when he opened his eyes, muttered a few words lighted a candle, went into the study and began to read. He was at this time studying French, and had to translate a passage out of the Italian. He ceased reading, took up the dictionary, and made his exercise, as well as if he had been awake.

They snuffed out his candle, when, without noticing other candles that were burning in the room, he went into the kitchen and struck a light, by which he rekindled his own candle and set to his task again. It was snuffed out again. He shut the window, as supposing the wind had blown out his candle, which he lighted anew; when Porati blew it out. He now grew impatient. He stirred the embers, took some matches in his hand, and said—'Is that fire, or is it not?' He lighted the candle and went into the study, where he took a dispensatory, examined by it some plants that stood ready for distillation, and found one right after the other. Porati now spoke to him about the plants. He immediately heard and answered as rationally as if he had been awake. He then fell asleep, soon awoke, and was sent to bed

On another occasion a remark he made, on a book which he was reading, excited in one of his comrades a suspicion that he was feigning. To ascertain this, the comrade held the flame of a candle to his hand, but he did not withdraw it. Next morning he complained of a pain in the place, but did not know how it came

He was repeatedly observed not to know any person or thing but what coincided with his passing train of ideas. When he went into the shop, if faulty recipes were brought to him, he would soon detect the error, but did not know the persons who brought them, though they were his own comrades, but took them for servants who came for medicines. He often tried to light a candle at a lamp standing under a glass bell, of which he was not aware; and it was observed that he could not distinguish two powders of which one had a strong smell and the other was without any. It was accidentally discovered that the waving of a fan threw him into a quiet sleep, and this expedient was frequently employed to stop him when he attempted to do what his master did not wish. The effect of the moving air was to arrest him suddenly, upon which he would sink down and sleep a short time, but his paroxysm went on afresh afterwards.'

We must be better acquainted with the rationale of function, and know more of pathology than we now do, before we can explain these and other curious and remarkable susceptibilities and peculiarities of the sentient and percipient organisation. They must, however, be considered as objects of considerable interest; and perhaps future pathologists may come nearer to a free exposition of their theory than at present is generally conceived to be possible.

412. Class 3. *Cachexia.*—The disorders which should be properly included under this head, would be those which according to the doctrines of the humoral pathology, and according, indeed, to vulgar phraseology and opinion, are considered

indications of a bad habit, as it is expressed, which means, if it means any thing, that the humors of the body, instead of being what they ought naturally to be, have undergone some change either in their physical or chemical condition, which is inconsistent with a state of absolute health. Thus should a wound, instead of healing kindly and regularly, show an indisposition to come to this favorable termination, without any thing in the character of the wound itself, or in exterior circumstances, to account for the tardiness; or should a chronic eruption break out on the surface of the body without being excited by imparted virus, or independently of any pyrexial irritation, the individual subject to such complaints and conditions would be considered in a bad habit of body.

But these vague sort of explanations do not satisfy the pathological precision of present times, and we look for something more satisfactorily explicative than this terminology supplies. It must, however, be confessed, and we have already intimated the same thing in the proem to the present article, that the physiognomy and character of some chronic disorders is not easily explained upon any other hypothesis than those which the humoral doctrines present to us. As, however, these cachectic disorders are for the most part disorders of the assimilating and absorbing functions, it will be consistent with what we have already done in reference to the pyrexial and nervous classes of ailments, to engage in a preliminary sketch of the more prominent and primary disorders to which the absorbents, as a distinct system are obnoxious; a distinct system, however, we should hardly say; for, as it has been expressed by a modern author, 'whilst we thus survey detached portions of the animal economy, and examine the disorders to which each part is principally subject, it must be confessed that nature has not left them independent of each other. Nay, so far is she from having established an empire within an empire, that, with astonishing contrivance and unity of design, she has made each part subordinate to the rest; and hence it is that, if one is principally affected, the other sympathise and are drawn into action by consent.'

This idea is beautifully expressed by Hippocrates, when he compares the body to a circle in which we can find neither the beginning nor the end, and then remarks that the same observation will hold good respecting its diseases.

Yet, adds our author, notwithstanding the efforts of nature to relieve herself are thus combined, they require for the sake of distinctness to be separately viewed, and, to cure diseases, attention must be turned towards the system chiefly affected, whether the arterial, the nervous, or the absorbent. And it is under this feeling that we now engage in considering generally the pathology of the absorbents.

It is well known that the celebrated Brown, as we have indeed before observed, attempted so great a simplification of vital powers and diseased habits, as to place every thing to the account of one principle pervading the frame, which he named excitability; but, were there no other error in his system, this single fact would be sufficient to subvert it from its foundation, viz. that different parts of the frame are under the distinct influence of different impulses. Thus those agents which excite one series of actions in the body will at the same time suppress others; for instance, nausea, or inaction of the stomach, occasions a temporary augmentation of the powers of absorption. The known varieties, too, of constitutional susceptibilities are all at variance with the above principles. While then we avoid falling into the vulgar errors connected with and derived from the humoral pathology, we must at the same time recollect that in different individuals, and at different periods of life, there is immense variety of kinds as well as degrees of susceptibilities and excitants.

Dr. Heberden observes, and it is a curious as well as important fact in the animal economy, that the lymphatic glands of the neck, groin, axilla, and mesentery, are more especially subject previous to the period of puberty to disordered action. At the time of puberty the pulmonary organs are principally obnoxious to disease, and in more advanced life the uterus and breast in females, and the prostate and other excretory glands in males, are the seats of morbid affection. Now these facts are susceptible of something like the following explanation. We have already stated that the evolution of organs is different at different stages of life. In infancy, and previously to the development of sexual peculiarities, those lymphatics and absorbents are chiefly called into action which are concerned more properly and especially in the growth of parts. To the head, the mesentery, and the extremities, is the blood now directed in a greater proportion; the deposition of calcareous matter forming bone is at this period proceeding with rapidity. Absorption is necessarily required and effected in the same ratio; and, in those constitutions which are characterised by constitutional laxity in the fibres of the exhalant and absorbing vessels, disease will most readily appear in these parts, which are now subject to the greatest degree of irritation.

The lungs at the age of puberty, as is indicated by the alteration of the voice and other circumstances, undergo a very material change. The osseous portions of the extremities and of the head being now rendered nearly complete, the growth and changes of these parts proceed more leisurely and tardily; the principal impetus of the blood is directed into other channels, new determinations (as it is technically expressed) arise, and constitutional excitement is directed from the parts above mentioned to the lungs. Hence the very frequent occurrence of pulmonary disorganisation at the time when the constitution is about to assume fully its sexual character; and hence the more usual appearance of a tendency to such disorganisation in those habits which are called scrofulous.

Individuals of such temperament are in after life subject to diseases of the organs above mentioned, in consequence of all weak parts being made more than ordinarily obnoxious to organic derangements by the abstraction of their accustomed stimuli. The breasts are no longer excited to the secretion of milk, the offices of the prostate

gland and seminal vessels cease, the uterus does not now acknowledge its former stimulus; and these organs, always more or less liable to disordered action, with difficulty resume their original state of inactivity without falling into actual and positive disease.

That condition of absorbent disturbance and derangement which constitutes the disease named by authors tabes mesenterica, as the source and origin of so many others, demands to be primarily considered.

Tabes mesenterica, or mesenterica atrophy, is characterised by the following symptoms. A prominence and hardness of the abdomen, with sometimes irregular and knotty protuberances, with an emaciation of the limbs, and a paleness of the countenance, unless when it is lighted up with a hectic flush. The bowels are extremely irregular, now constipated, and now in a state of more than healthy looseness: the stools, however, are never of a good appearance and consistence, they consist of slimy and mucous matter in place of proper fæculent discharges; the temper of the little invalid (for this is a disorder of infancy) is made peevish and fretful; when the malady arises to any height the child moans piteously, and cannot be brought to notice surrounding objects. It seems to be wrapped up in itself and in its complaints. After the state has continued some time, the limbs will not only be flabby and feeble, but they will become of a rickety deformity, and the patient is invariably taken off its legs, as the persons about children are in the custom of expressing themselves.

Now with a recollection of the functions and office of the lacteal absorbents and glands, and with a small knowledge of the physiology of adjacent organs, the rationale of the above mentioned appearances does not appear very difficult to trace. The tumefaction of the abdomen has some connexion with retained matter in the intestines, but is more especially connected with a disordered condition of the mesenteric glands. It will be proper here to observe, that this glandular enlargement is not, as might be supposed, occasioned by a mechanical obstruction to the passage of chyle, but is dependent upon a disordered action of the glands themselves. There is in fact less than the ordinary quantity of digested aliment in the mesenteric passages during this derangement of parts. Chyle is not duly secreted or manufactured, and on this account, not from a mechanical impediment to its progress through the lacteals, it is that a due quantity of aliment is not given to the blood; and hence the paleness and weakness of the subject of the complaint.

The torpid state or irregular action of the bowels, and the discharge of slimy, in place of proper fæculent evacuations, appear to have somewhat of a complicated origin.

For the due digestion, separation, and assimilation of the aliment, it is not merely necessary that a due action be preserved in the muscular fibres of the stomach, intestines, and lacteals, but it is at the same time requisite that the offices of what are called the assistant chylopoietic viscera be performed without interruption. For due and complete digestion and chylification the liver must pour out its bile, and the pancreas its peculiar secretion. It is further necessary that not only the quantity, but also the quality of these fluids be duly maintained. Now in that torpid state of the lymphatic or absorbent system which occasions tabes mesenterica, there is not merely a diminished quantity of biliary and pancreatic secretions, but such diminution is accompanied by a deficient stimulant property in these secretions, since from the inactivity of the absorbents their aqueous portions are not reabsorbed. Thus the duodenum receives them in a dilute weak state; a state in which they are incapable of either properly assisting in the requisite solution or preparation of the nutritious from the fæculent portions of the aliment, or of stimulating the irritable fibre of the intestine in order to eliminate the latter. Hence the discolored, slimy, and viscous appearance of the stools in children laboring under tabes mesenterica; and hence the irregularity as to time in which the alvine excretions are discharged.

With regard to the impeded growth, flabbiness of the flesh, paleness of the face, and ricketty deformities that in a greater or less degree arise out of this state of things, we have only to advert to the general laws of the absorbent system for an immediate explanation of them. During infancy, the principal office of the exhalant termination of arteries is the deposition of calcareous matter forming bone. Now, when the blood from which this secretion of osseous substance is obtained becomes deprived of its source of supply; when the chyle is, from the state of the mesenteric vessels, prevented from being conveyed to the blood-vessels, the lymphatic arteries are by consequence bereaved of their wonted stimulus to action; the earth of bone (principally phosphate of lime) fails of being duly deposited; the limbs, instead of gradually acquiring firmness and strength, remain soft and yielding; rickety deformity presents itself, the want of a proper quantity and consistency of blood occasions paleness, and every function is either torpid or irregular in its display.

Such then is shortly the history and rationale of mesenteric atrophy; and scrofula, which has been treated as a distinct disorder, may perhaps be represented rather as the cause for the most part of other diseases, than a disease itself. Thus it is a scrofulous weakness in the lacteal and lymphatic vessels that causes tabes mesenterica; and this last may be looked on as the root of almost all other diseases of lymphatic debility. In some cases, however, scrofula appears as a decided tendency in the habit, without occasioning other diseases, and sometimes there are inflammations and ulcerations in different parts of the body to which we can give no other name than the general one of scrofula. The marks of a scrofulous tendency, and the general characters of these scrofulous irritations, it therefore behoves me more briefly to point out. A fine transparent skin, a full blue eye, and an extraordinary whiteness of the teeth, are the signs of the scrofulous diathesis which are most usually pointed out by authors; but it has been with

propriety remarked, by other writers, that a dark eye and dark hair are frequently connected with the scrofulous tendency; and when that is the case an apprehension of its consequences upon the system would seem even to be better founded than in the former case, since the lymphatic and glandular irregularities to which it disposes are of a more torpid, more fixed, and more deep-seated kind. Consumption of the lungs creeps on insidiously upon these subjects: insidiously since there is not that external disposition to lymphatic irritation in so great a degree as in the more obviously scrofulous. In these the lymphatic glands in the neck, in the axilla, and indeed in all parts where they are found in abundance, are very apt to take on a diseased state, and when from mere inflammatory irritation they form into open ulcers or abscess, these ulcerations are called scrofulous. Now one very remarkable characteristic of these tumors, when they come to ulcerate, is, that they do not pour out pus, properly so called, as humors of other kinds and other parts do, but a sort of curdy chalky-like matter issues from the wound, which John Hunter has described as the coagulating lymph, deprived of its serum; it would seem however to be a peculiar secretion, occasioned by the condition of the lymphatic vessels when thus the subject of scrofulous irritation. Scrofulous ulcerations are exceedingly difficult to heal, and will often continue for months in an indolent kind of state with irregular edges, indeed when they tend inwardly upon the bones they last sometimes in this state for years, and come to produce erosions, and exfoliations, and caries, the history and progress of which will fall to be detailed in the article SURGERY.

The cure of scrofula is generally directed to the treatment of its particular manifestations; but we shall have occasion to offer a few remarks on this head in another place.

Dropsy is another affection which has to do in an especial manner with the absorbents. This disease is constituted by a collection of lymph into cavities, which, not being taken up and returned into the blood vessels, remains as extraneous matter, and causes the swellings by which the complaint is characterised. The different kinds and species of dropsy, when they arise principally from inflammatory irritation, and when they are rather the result of pure and direct debility in the exhalant and absorbent vessels, will be canvassed forthwith under the head of *Dropsy*. It may be here sufficient to remark that in no case, either of general or local dropsy, can the malady be established without an absorption disproportionate to the exhalation, and that consequently dropsies have a singular right to be classed as lymphatic diseases.

Of rickets scarcely any thing further need be said than that it is almost the same affection with mesenteric atrophy; and how the ricketty growth of bones becomes established in that affection namely, from the blood-vessels not receiving their due supply of good chyle, we have already endeavoured to explain.

Mollities ossium, or softness of the bones; in which indeed they become so deprived of their osseous matter as to lose all the character of bones, is a disease not of very ordinary occurrence. When, however, it does take place it must necessarily be in the way of either deficient action in the exhalants, or excessive, or rather disordered, action in the absorbents, by which either a disproportionate quantity of osseous matter is taken up from the bones and reconveyed into the circulation, or there is an insufficient secernment of this substance from the blood-vessels.

But perhaps we cannot better continue this preliminary view of absorbent susceptibility and peculiarity than by an extract from the elements of Therapeutics by Townsend, a work, which although faulty in many particulars, and in the one of a too hasty reception of the pneumatic doctrines which were prevalent at the time the author wrote, yet contains much of what is correct in pathology, and useful in practice.

Nothing in nature, says Mr. Townsend, can be more worthy of admiration than the vital action of the absorbents; and it is curious to observe that their activity continues unimpaired whilst sensation and the animal functions are perfectly suspended. This will be evident if we consider that, during sleep, the bronchial mucus is much thickened, and that both the urine and the fæces show the continued progress of absorption.

In our wonderful machine, to prevent friction and adhesions, it is required that vapor should be interposed between contiguous parts, more especially if either of them is designed for motion. This the excretories provide; but, as it must be frequently renewed, absorbents are incessantly at work, to convey it back into the mass of circulating fluids. Dr. Musgrave injected twenty-four ounces of water into the thorax of a dog, and in five days the whole was taken up by the absorbents, for the breathing became as free as it had been before this water was introduced into the chest.

In case of dropsy, nature, by means of the absorbent system, makes wonderful efforts to relieve herself.

John Hunter relates the case of a lady, with swelled legs, who made little or no urine, and was so weak that she could scarcely articulate. She dozed incessantly, and had no desire for food. Her pulse was hardly to be felt, her feet and all her extremities were cold, yet, within thirty-six hours of her death, the whole water in her legs and thighs was absorbed, her urine was increased, and, about ten hours before she died, her legs and thighs were as small as ever. Hoffmann, in confirmation of what is said by Aretæus, assures us, that he has seen many perfectly cured by a spontaneous and long continued diarrhœa. But what is most surprising is, a case recorded by Fernelius, Pathol. lib. 6, in which ascites was relieved by the approach of the menstrual period by a profuse discharge of water, which continued for two days; and when, in the interval of menstruation, the serous fluid had been collected, it was the next month entirely discharged by the uterus.

Some kind of vessels, as I have stated, are employed to take up the roscid lymph from the ventricles of the brain; but the office assigned to the common cellular absorbents is twofold; for they not only imbibe the aqueous fluid from the

reticular part of the cellular membrane, but, when it is needful, they absorb the animal oil from the little bags in which it is deposited, and convey it wherever it is wanted for the purposes of life.

When there is any extravasation either of lymph, of serum, or of blood, they remove it; and when extraneous matter gets into the system, if this proves injurious, they quickly go to work; or, if any part is either dead or useless, it proves a sufficient stimulus to excite their action.

In cases of gangrene, both sloughing and exfoliation are produced by the absorbents, and thus a separation is made between the living and the dead.

When whole parts are to be removed, as useless, without producing solution of continuity in the surrounding parts, this can be accomplished only by the action of the absorbents. It is thus the thymus gland, the ductus arteriosus, the membrana pupillaris, are obliterated, and thus also the fangs of diseased teeth, with their sockets, are quietly destroyed. It is by this process that aged women lose their breasts, when these are no longer needful. When the cataract has been extracted, the absorbents take up the capsule, and frequently, more especially after couching, they carry off the cataract itself. The diseased testicle is removed by them, and sometimes in cases of necrosis they devour the bone itself. It is by this process that schirrous tumors are removed.

Du Hamel has demonstrated, by his experiments, that the earthy parts of bones, on which they depend for solidity and strength, are unremittingly renewed, whilst the absorbents carry off, and exhalant arteries as constantly deposit calcareous matter. This discovery he made by feeding animals alternately with common food, and with this strongly tinged by rubia tinctorum; in consequence of which their bones were variegated red and white. But when he had ceased to give the madder for six weeks this redness vanished.

When either extraneous bodies or dead parts, which cannot be absorbed, cause irritation in the system, the absorbents destroy the intermediate living parts between the offending matter and the nearest external surface of the body. It is by this process that nature frequently relieves herself in cases of necrosis and of extra-uterine conception. And it is thus that pus, when produced internally, exfoliated bones, and all extraneous matters, are discharged. But sometimes it happens that, whilst the ulcerative process is destroying the inside of a bone, the ossifying process makes addition to its outside, and the bone increases to a prodigious size; but in the end the ulceration on the inside gets the better, and the matter makes its escape. Whenever incysted tumors are formed in the cellular membrane, the whole substance between them and the skin is in process of time taken up by the absorbents, and then inflammation commences to produce a quicker absorption, which borders often upon ulceration. It is thus that the tumor is exposed. John Hunter mentions a case which came under his inspection, in which a tumor, formed upon the brain, excited to such a degree the action of the absorbents, that without ulceration they carried off the opposing portions of the dura mater, of the scull, and of the scalp.

When there is offending matter in the system, which cannot be expelled by the usual outlets, the absorbents convey it back into the mass of circulating fluids to be thrown out by the emunctories. Thus it is evidently in jaundice; for the bile, being prevented from passing by the common duct into the intestines, is taken up by the absorbents and secreted by the kidneys. And, when mania and melancholia are relieved by cuticular eruptions, we are probably indebted to the absorbents; for upon all occasions they are ready to assist nature in her efforts to relieve herself. John Hunter mentions a young man who had a large bubo in the bottom of his belly which, having suppurated and being on the point of breaking, was suddenly absorbed. While this process was going on he observed his urine wheyish and thick, as it was coming from him; but this went off entirely when the bubo had subsided.

Since the absorbents act, not by capillary attraction, but with vital energy, which is liable to increase and diminution, it is evident that their activity may be either deficient or excessive. But whatever produces either direct or indirect debility lessens the action of the absorbents, because the vital energy is injured equally by both.

I. Direct debility is induced, *α*. By deficiency of wholesome nutriment, when it fails either in quantity or quality. This we observe among people who live chiefly on the legumina, peas and beans, or on other unfermented vegetables, with dried, smoked, and salted fish, as in Holland; on cucumbers, melons, pompions, and other vapid fruits, as in the watered provinces of Spain; or on bread, water, tea, as in some parts of England. *β*. By deficiency of exercise, more especially when the indolent and inactive spend most of their time in sleep. *γ*. By sudden and profuse evacuations. *δ*. By impure air with excess of humidity. *ε*. By such poisons as are directly sedative, among which I am inclined to reckon bile and the menstrual secretion retained.

II. Indirect debility is induced by excitement either violent or long continued, and therefore by such poisons as are indirectly sedative, that is, whose first operation is stimulant. We have seen, by the experiments of the Rev. Dr. Hales on vegetables, that their vital energy constantly accumulates during the night, and is to a certain degree exhausted by the stimulus of light and heat before the middle of the day. And we observe, not here particularly to mention heat, that wine, spices, spirits, have precisely the same effect on the absorbents, as may be seen in gluttons, and in drunkards whose spleen, pancreas, and liver are frequently discovered to be schirrous.

The consequence of defective action in the absorbents must be disease, such as obesity, indolent tumors, aqueous accumulation, and herpetic eruptions.

Excessive action of the absorbents produces atrophy, and may arise from either general excitement, as in acute fevers, or partial stimulants. The stimuli may be irritating substances, such as

pears passing constantly over the cheeks; or pressure, whether by external objects, by indolent tumors, by pus, or by aneurisms, all which cause the lymphatics to absorb, not only membranes and muscular fibres, but the bones. Thus, in case of a large aneurism of the aorta pressing against the back-bone, the artery is first absorbed where it comes in contact with the bone, and continues to waste till the whole is taken up, after which the bone itself is soon consumed; but, as the surrounding parts unite by adhesive inflammation, a cavity of some strength for the circulating blood is always kept entire, and no extravasation can take place, nor can the parts readily give way. Thus also, when in palpitations of the heart repeated pressure is made upon the ribs, they likewise are absorbed. We must suppose not only excessive but mistaken action of the absorbents, when, from external inflammation in the eye, they take up both the crystalline and the vitreous humors, leaving only a bag of water. When this happens to cataracts produced by contusion, and therefore by inflammation, we must attribute it, not to morbid action, but to the well directed efforts of nature to relieve herself.

One species of morbid action in the absorbents is not easily reconciled with the general laws of the animal economy, but the effect is too readily discovered, which is when they convey poisons into the system, such as the variolous, syphilitic, cancerous, canine, and others. Nor can we understand for what reason they translate matter from cancers and scrophulous tumors to distant, and sometimes to more noble parts, than those which suffer. This however, like many spasmodic affections, seems to be merely an effort of impatience, whilst the ordinary efforts appear to follow the most calm deliberation, and to be directed always by the best intention.

With regard to the general indications of cure in morbid action of the absorbents.—These must be derived from a consideration of the causes which produce morbid action, whether it be deficient or excessive.

In cases of defective action of the absorbents, the first attention must be paid to diet, which should be mild, yet generous, consisting of such articles as are most easy of digestion, with a moderate quantity of spice and wine. Further to assist the digestive powers of the stomach, and the general action of the absorbent system, recourse must be had to air and exercise. It is Boerhaave who has left us this direction:—Tum ut optimè digeri queant, condimentis, potu vinoso, exercitio, aëre, procurandum, § 1176.

By experience, all medical practitioners have been convinced that health and vigor depend upon the air we breathe: but no one, till Dr. Beddoes wrote upon the subject, was ever able to explain what the air contributed towards heat and life. They had observed that the blood acquires a florid color by passing through the lungs, precisely as when venal blood is exposed to the open air. They had remarked that the blood of those people was most florid who used most exercise; and that even the blood of horses after a long journey was more florid than when they had been confined without exercise in stables. They saw clearly that the blood of a cachectic woman is watery and of an obscure red; but that by increasing the blood's motion with friction, exercise, and medicine, it recovers its bright color This change they attributed to its passage through the lungs, where, according to Galen and the ancients, it received some spirit from the air imparting vital energy to the arterial blood. Boerhaave, from whose Institutes these quotations are taken, also asserts that the lungs receive something from the air, the nature of which he confesses himself unable to discover; but, in order to account for the red blood of fish, and the redness of the punctum saliens in an egg, he observes, that the gills of fish supply the office of lungs, and that air penetrates the egg to support the life and growth of the included chick, § 200—202.

Baron Van Swieten, in his Comment on the Aphorism of his master, Boerhaave, wherein air is recommended, has remarked, that prisoners excluded from the air, and patients long confined to hospitals, become cachectic; that in such situations it is very difficult to cure them; and that hence we may understand, why atrophy attends affections of the lungs, even when little is discharged by spitting, or lost by sensible evacuations. § 1174, 1176.

Exercise increases respiration and promotes the oxygenation of the blood; and by this it gives vigor to the system, and excites the action of the absorbents. It is the circulation of the blood which distributes vital energy to every part; for in syncope, and even in death, when it is a consequence of suffocation, all the vital organs remain perfect and entire; but for want of distribution of vital energy, by the circulation of blood, neither the heart, the lungs, the stomach, nor the brain, can perform their office; there is neither secretion nor excretion, and all action, both vital and voluntary ceases.

In those cachectic diseases, in which the circulation of the blood is languid, in vain will you pour in nutriment, unless at the same time by air, by exercise, and proper medicines, you promote the circulation, and consequently the secretion with the vital energy of the absorbents. Muscular motion, by compressing the veins, sends the blood with increasing vigor to the heart, which strongly stimulates that organ; the respiration is much quickened, the blood becomes highly oxygenated in its passage through the lungs, and in its return excites the heart to more powerful exertion, by which the whole arterial system is distended. This stimulates the vessels to contract with vital energy; the action and eaction are great; the contractions strong; all is activity, all is vigor. Hence it is that if, of two brothers, one takes to a sedentary life, and the other is constantly engaged in hunting, shooting, fishing, or in the cultivation of the earth: this, with a ruddy countenance and rigid fibre, will enjoy high health; whilst the other pale, bloated, and relaxed, will be incessantly consulting his physician.

Of the different kinds of exercise none is to be preferred to riding, because it agitates every part of the machine, and most powerfully promotes the action both of the exhalants and absorb-

ents. Sydenham relates the case of a friend, who, by neglect of exercise, had brought himself into so deplorable a condition, that he was dying of a colliquative diarrhœa, which no medicines could relieve. This man, by the advice of his sagacious physician, mounted his horse, defied all weather, paid no attention to his diet, but rode at first short distances in proportion to his strength, and continuing this practice without interruption for many months, came at last to ride his twenty or thirty miles a day without fatigue, and was restored to perfect health and strength.

Dr. Stack was consulted by the relations of a young nobleman then dying of atrophy, as it was thought, in Paris, to whom he recommended the Bath waters. The young nobleman was driven to despair by this advice, because he could not walk across his room, and was confined chiefly to his bed. But the marchioness his mother, a lady distinguished for spirit and resolution, prevailed on him to rise, supported him in his carriage, revived him with cordials when he fainted, and, by short stages at first, in less than six weeks brought him to my friend at Bath in perfect health.

In a very ancient history of Cornwall mention is made of M. Atwel, a clerical physician, who infallibly cured all diseases; and so great was his celebrity, that patients travelled to him from every part of the island west of London, to know what quantity of apples and milk, (for, excepting manus Christi, and such like cordials, that was the only medicine he prescribed,) would be good for them. Few of these, if they came from a great distance, consulted him in vain; before they got home they were restored to health. *Carew's Survey of Cornwall*, p. 60.

Sydenham assures us, that he has frequently cured both tabes and phthisis by horse exercise and long journeys, when all medicines had been given in vain, and this not merely in the incipient stages, but when night sweats and diarrhœa, usually the concluding symptoms, had appeared. Morton expresses in most energetic language some sentiments respecting the benefits to be derived from air and exercise, and we may venture to affirm, that most kinds of cachexy may be cured by these alone, even without the aid of a physician.

Frictions, in some degree, answer the end of exercise, by diffusing vital heat and promoting the circulation of the blood. The benefit to be derived from hence is evident in horses, who never enjoy high health when confined to stables, unless they are well combed and brushed.

Bandages, by pressure, assist weak vessels and promote absorption. It is for this reason that Boerhaave recommends compression in diseases of the weak relaxed fibre, because when either fibres or vessels are distended beyond their tones, their vital action will be weakened till it is wholly lost. And John Hunter has admirably stated that the best exciting power is pressure, which, if urged beyond the point of ease, sets the absorbents of the part to work, for the purpose of removing either the substance pressing or the part which is pressed. These therefore, in some cases, may be usefully applied.

In cachectic patients, attention must be paid to the organs of digestion, which are usually deranged, and loaded either with indigested sordes, corrupted bile, or phlegm. If the stomach is affected, an emetic must be given; or, if the smaller intestines require to be cleansed, gentle cathartics will be required, which in most cases may be followed by tonics and astringents. This Boerhaave has enjoined.

Ut verò organa primarum coctionum itidem benè disponantur, leni digestivo, vomitivo, purgante roborante, prospiciendum, § 1177.

But, whilst emetics prepare the digestive organs for tonics and astringents, they in many cases serve another useful purpose, by promoting absorption in every part of the system. Cathartics have the same effect, and among these none is more powerful than mercury, whether externally or internally applied. Indeed every increased evacuation excites absorption from distant parts, but, independent of this effect, mercury stimulates the absorbents, and thereby excites their action. Diaphoretics and diuretics unequivocally act upon the absorbents.

But the most effectual stimulant in all cachectic cases, attended by diminished excitement, is steel. This was the favorite remedy of Sydenham, and Boerhaave, and it has continued to maintain its credit, in the hands of all the most successful practitioners, to the present day. To this Dr. Smith owed his celebrity; and, from the experience of thirty years, I can venture to assure the student, that in few cachectic cases will it ever fail to cure. Professor Van Swieten says, 'In practice I have met with innumerable cases in which cachexy has been cured by this remedy alone, joined with grateful aromatics, after mild evacuants had cleared the first passages from mucus, filth, and indigested food; and he particularly assures us, that by steel filings he never failed perfectly to cure cachectic virgins, provided they consented to take air and exercise, and to avoid warm liquids.'

Chalybeates have certainly a two-fold effect; for as the natural vehicle of oxygen, and the constituent principle of red blood, they strengthen the digestive organs, and they excite the absorbents. Indeed all the metallic oxides, excepting the mercurial, act in the same manner, only in a superlative, and, therefore, in a less manageable degree. For this reason iron has maintained its empire; and whilst we have one oxide, which, when conjoined with the inhalation of vital air, in these cases may be regarded as infallible, we need be less solicitous about the rest.

I cannot conclude this article without making mention of electricity, which, as a powerful stimulant, has not only reduced swellings from sprains, and promoted the speedy absorption of considerable glandular and scrofulous tumors, but is known to attenuate fluids, and to excite strong action in the animated fibre, by which, among other remarkable effects, it quickens vegetation, increases perspiration, and restores the menstrual flux.'

Had our author been writing at the present moment he would have added, to this recommendation of electricity, the Voltaic modification of it; for it will be seen throughout the whole

the long extract which we have made, that there is a readiness evinced on the part of the author to receive every modern suggestion as an improvement.

Had he lived too to hear of the late experiments of Magendie, he would gladly have availed himself of them in adding moderate and judicious depletion as one of the most powerful means we possess of exciting the absorbent action. The experiments of the physiologist we have just named have always appeared to us exceedingly important in reference to this particular, and we should be disposed to place the practice referred to at the head of stimuli to the absorbent faculty. The principle upon which it proves to be so, seems that of removing a load from the vessels, and thereby enabling them to act with more freedom. We may here then advert to some important experiments of Magendie in reference to this point. 'I endeavoured,' he tells us, 'to ascertain by experiment the influence upon absorption which should be exerted by a state of fulness in the sanguiferous vessels. Having injected into the veins of a dog a certain quantity of water at the temperature of 40° (105° of Fahrenheit), I introduced into the pleura a solution in alcohol of nux vomica, the absorption of which was proved by its speedy and powerful effects. The effects, however, were not so immediate as had been the case when the veins were not thus previously injected; and in repeating the experiment, with a still greater quantity of water in the veins, I found that the effects of the poison were in the same measure more tardy in showing themselves; at length having thrown in as much water as it was possible for the animal to receive while he continued alive, the poison which in ordinary circumstances would have operated in less than two minutes, had not affected at the end of half an hour.'

'The condition,' Magendie continues, 'of the blood-vessels in reference to their plenitude was shown by these experiments to possess a considerable influence upon their absorbing power. What then, it became interesting to ascertain, would be the effects of an opposite state of these vessels? This was likewise put to the test of experiment in the following manner: a dog having been largely bled, the same quantity of nux vomica solution was thrown in, as in the former experiments, and the poison manifested itself in little more than half a minute, while, under ordinary circumstances, it would have required two minutes to produce the effect.

The veins of another dog were opened, and a given quantity of blood having been withdrawn, it was replaced by an equal quantity of water; in this case the absorption of the poison took place about the ordinary time.'

By these experiments then it is clearly manifested that plenitude of vessels, beyond a due proportion, interferes with the absorbing agency, and hence blood-letting, properly regulated, proves itself to be a stimulus to the absorbents, and is thus applicable to several diseased states that demand ultimately stimulating and supporting remedies.

There are some other medicinals beside those mentioned by Townsend, which likewise seem especially to operate upon the absorbent faculty. Digitalis may be instanced as one of these; hence its utility in dropsical swellings; and hence it has been used in those mesenteric affections to which we have above alluded, as the radix and source of many disorders incident to children. See the two first genera in the present class Iodine too, which has lately been employed for the discussion or dispersion of glandular enlargements, particularly that enlargement of the thyroid gland called bronchocele, seems as far as its influence can be traced to expend its virtues mainly upon the absorbents. We must not, however, expect to be able to trace this exclusive agency upon one part of the frame through the action of any one power or any one medicinal, but at the same time it much assists the therapeia of medicine thus to observe the particular influence of some drugs, or some excitants upon one more than another portion of the system; and, while we should be careful not too hastily to generalise, we should avoid being merely empirically observant. The exciting passions, as well as those that are sedative and depressing, may be made to stimulate the absorbents as well as other parts of the frame. In this case the influence is probably an extension of that which is primarily communicated to the sentient part of the organisation; and it is more than probable that hope and confidence, as well as exercise, had to do with these cures to which Mr. Townsend alludes as resulting from the invigorating and exciting power of exercise; indeed, the medical practitioner should never act without the recollection of the astonishing influence which the mental faculties possess over the physical functions of the frame, and, in those instances where the manifestation of good has principally been made through the medium of the nervous system, it may be that a considerable portion of the therapeutic effect has actually been produced through the blood-vessels and absorbents.

We now, then, proceed to consider the order and genera which Dr. Cullen has introduced, in some cases with obvious impropriety, into the class cachexia.

413. Order 1. Wasting. Emaciation.

Tabes. Atrophy.—The former with hectic fever, as having more to do with the absorbent system; the latter being without hectic, and therefore, although the falling away in flesh and strength must necessarily in its course be considerable, connected with the absorbent power, yet the nervous or sentient system seems to be the part primarily and principally affected.

'When,' says a modern author, 'the falling away in flesh and strength is connected with a disordered condition of the nervous and muscular energy, those plans of treatment are required which give tone and vigor to these parts of the frame; such as the vegetable bitters, the various barks, and the metallic tonics. When the complaint is rather tabid than atrophic, and the lacteal system is especially implicated, medicinals are called for, which stimulate this portion of the system. For the tabes mesenterica of infants I have found nothing better, in the gene-

ral way, than the hydrargyrus cum cretâ of the Pharmacopœia, with very small doses of digitalis.

℞ Hydrarg. cum cretâ gr. ij.
Fiat pulvis omni nocte sumendus ex vehiculo crasso.

Take of quicksilver with chalk two grains. Make it into a powder. To be taken every night in something thick.

Tinct. digitalis ♏ ij. ter in die sumendæ gradatim augens quantitat. usque ad ♏ vj.

Let two minims of digitalis be given three times a day, gradually increasing the dose to six. This combination of medicinals seems to be deobstruent, and excitative of the lymphatic and lacteal vessels; and in more advanced life, when nutrition seems impeded in consequence of defective action in the mesenteric absorbents, stell will, in general, prove one of the best stimulants. It will, for the most part, I think, be found, that steel is rather applicable to the tabid state, and other tonics to atrophia.

414. Order 2. Swellings.—*Corpulency; pneumatic swelling; tympanitic, or drummy swelling; uterine inflation.* Physometra.—The same author from whom we have extracted the above, places these four genera together and upon them makes the following remarks:—Corpulency needs no description; its obvious remedy is to lessen the ingesta, and increase the absorbent energy, which is best done by exercise. Emphysematic, or windy, swelling, is occasioned by a collection of air in the cellular membrane: it is attended, as the definition states, with a crepitating or creaking noise, and occasionally spreads over the greater part of the body. It is sometimes produced by wounds in the lungs, sometimes arises spontaneously, or without any manifest cause, and occasionally occurs in an inexplicable manner, from certain kinds of food that prove poisonous. When the collection of air is excessive, so as to prove troublesome, and happens in the thorax so as to impede breathing, scarifications of the cellular membrane will be found necessary. In all cases the occasional cause is of course to be sought for, and if possible subdued.

Of the drum-belly, as it is called, there are two species; the one abdominal, occasioned by a collection of air in the peritonæal cavity; the other intestinal, formed by air in the cavity of the intestines. In the former the swelling is more diffused and equal than in the latter, and there is not that emission of flatus which attends the tympanites. The continuance of either tends to dropsical effusion; indeed tympanites and ascites are not unfrequently combined; and they seem occasionally to alternate with each other. At this time I am attending a patient whose abdomen on one day or week seems distended with flatus, on another there are complete indications of watery collection.

Causes.—Debility in the absorbent or exhalant systems; intemperance, or low living; distending the stomach with tea, in place of taking more wholesome and substantial nutriment. Sometimes the suppression of ordinary evacuations will occasion tympanitic enlargement. Mental anxiety will produce it.

Diagnosis.—From dropsy, tympanites is distinguished by there being in the latter no fluctuation, while the former is without crepitus. There is not, necessarily, in mere tympanites œdematous swellings of the ancles, nor paucity of urine.

Prognosis.—Obstinate cases of abdominal tympanites often prove fatal. The intestinal is of a more fugacious and symptomatic kind, and is remediable by the removal of the causes upon which it has depended.

Treatment.—Expulsion of the wind in the first instance, and restoration of tone in the second, are the indications of treatment. Carminatives are required to fulfil the former, tonics are demanded to effect the latter.

℞ Spiritûs ætheris nitrici,
Spiritûs sulphurici,
Spiritûs ammoniæ aromaticæ, āā f. ʒß.
Aquæ menthæ piperitæ f. ℥iß.
Fiat haustus.

Take of spirit of nitric æther of sulphuric ether and of aromatic ammonia of each half a fluid drachm, peppermint water a fluid ounce and a half. Make them into a draught

℞ Decocti aloes compositi,
Infusi cascarillæ, āā f. ʒvj.
Fiat haustus.

Take of compound decoction of aloes and infusion of cascarilla of each six fluid drachms. Make them into a draught.

℞ Pulveris aloes compositi,
Pulveris cinnamomi compositi, āā gr. viij.
Olei carui ♏ ij.
Mucilaginis acaciæ q. s.
Fiant pilulæ iv.; bis terve in die sumendæ.

Take of compound powder of aloes and compound cinnamon powder of each eight grains, oil of caraway two minims, mucilage of acacia enough to make four pills. To be taken two or three times a day.

Warm plasters, as the cumin and compound galbanum plaster, may be laid on the abdomen with advantage; the abdomen, too, may be bandaged; if the species be abdominal, and not intestinal, puncturing may be had recourse to.

In order to restore tone, the barks, especially cascarilla, are indicated, or other tonics; while during their use, as well as during the employment of warm purgatives, all flatulent articles of diet must be carefully abstained from, more especially the legumina—beans and peas.

Uterine inflation we cannot suppose to take place to any extent, unless there be some vaginal obstruction to the passage of the air. It seems, however, to be an admitted fact, that air does occasionally collect in the womb, and discharge itself from the vagina in considerable quantities and considerably to the annoyance of the patient.

413. *Dropsies.*—In the proem to the present article will be found some intimations principally extracted from a modern writer on the general pathology of dropsical affection; it will be observed that the principle of referring watery accumulation to any one cause was combated and it was moreover intimated that pathologist

of the modern school, in their eagerness to oppose the old assumption of dropsy being attributable to debility, had in some instances too largely and gratuitously inferred the necessity of inflammatory action previous to the throwing out of the serous collection constituting the disorder.

It was at the same time admitted that these inflammatory conditions are necessary to be recognised under several circumstances of dropsy; and upon the whole it was concluded that a mixture of the old and new admission of hydropic production is that which is likely to lead to a correct view of the subject.

We now proceed to illustrate these principles by considering the several affections which are comprised in the class; but we shall not pursue the same order which Dr. Cullen has adopted in the arrangement of the genera, for we consider the more natural arrangement to be that of dropsy of the abdomen (ascites), of the chest (hydrothorax), of the womb (hydrometra), and of the head (hydrocephalus). Hydrorachites or spinal dropsy, and hydrocele or dropsy of the scrotum, will be treated of in the article SURGERY.

414. *Dropsy of the abdomen.* Ascites.—It will be recollected that, when treating of inflammation generally, we adverted to two distinct kinds of this disordered action, viz. the phlegmonous and the erysipelatous, the one being circumscribed and deep seated, and more especially tending to suppuration; the other being spreading, and membranous, and disposed more particularly to effusion. Now there is one species of dropsy which has its origin in this erythematic kind of inflammation; and it is absolutely necessary in every case of dropsical effusion to aim at investigating the prior circumstances both local and general, in order to ascertain how far the effusion has or has not been occasioned by inflammatory action. Let us further notice the especial characteristics of that which we may term inflammatory dropsy of the abdomen, a very frequent concomitant of diseased or obstructed liver. What are the vascular conditions of the abdomen occasioned by such obstructions to the free circulation of blood through the liver? It is sufficiently easy to conceive that the blood-vessels which terminate in the vena portæ must necessarily, in consequence of this vessel becoming obstructed either in its trunk or its branches, be more disposed to plenitude than is consistent with their natural condition; that such plenitude will extend itself to contiguous vessels; that thereby congestions will be induced; and, should the body at the time be exposed even to slight causes of inflammation, such inflammation will come to be readily established; that this will assume a chronic, and perhaps indolent kind of character; that where cellular kind of substance exists it will take on an erythematic aspect; and, where other kind of membranous texture is the seat of the inflammation, the disposition will rather be to the effusion of coagulating lymph; that thus effusions and adhesions will either separately or conjunctively be established, and dropsy will be formed either with or without adhesive unions of membranous structure. But even this kind of inflammatory dropsy may at times take place in the abdomen without the preliminary condition of diseased or obstructed liver. Let it, however, be recollected, that obstruction to free circulation through other viscera may be attended with the same effect. That any circumstance which interferes with the due transmission of blood through the substance of the spleen may be the occasion of hæmorrhage has already been remarked; and it may now further be stated, that the same circumstances of this viscus, which in one subject or at one particular time of life predisposes to hæmorrhage, may, under different circumstances, and at different ages, have a tendency to induce congestion, inflammation, effusion; and thus to form dropsy. But further, even obstructions to the free circulation through the heart may, under certain tendencies in the body, conduce to the same event. Hence we see affections of the heart and of the lungs, not only terminating at times in dropsy of the chest, but in general dropsy, and dropsy of the abdomen, in which case, as indeed in all others of congestion, inflammation, and effusion, we have two causes operating: there is the vascular fulness consequent upon the blood being as it were thrown back upon the vessels by not having a free transmission through the chambers of the heart, and there is the tendency to effusion arising out of the very debility that was the first cause of the obstruction supposed. When then there is in the age, or the constitution, or both, a bias towards dropsical accumulations, we see how readily this is converted into the actual state by any obstruction occurring in the more important viscera, and the most common media through which this kind of dropsy is engendered are the liver, the spleen, the heart, and the lungs. Let then the practitioner, when he is called to judge of the nature and to determine on the treatment of dropsy, always pay great attention to the condition of these respective viscera, and to the presence or absence of general inflammatory irritations. But what is the essence of that species of dropsy which may be designated by the title of serous? Dropsy, let us recollect, is a preternatural increase of serous exhalation. The immediate cause of it then must in all instances be a loss of balance between the exhalants and absorbents; now this want of healthy correspondence, so to express ourselves, between these two orders of vessels, may be either positive or relative, that is, the absorbents may continue their due activity, and take up their usual measure of effused fluid; they may even do more than common; and yet, from the excessive exhalations, that more may not be equal to existing circumstances, and dropsical accumulations will take place by virtue of increased activity in the exhalants, which is the case in the inflammatory dropsy that we have just been conceiving. On the other hand, this effusion may not be more than natural or healthy, and yet, inasmuch as the absorbents have lost somewhat of their wonted tone and action, the same accumulation will take place, although in a different manner, as in the former instance. But here, of course, both the systematic and local disturbance will assume a different aspect; there will in this last case be more of torpor, and less of irritation, more of

paleness and weakness, and cachexy as it is termed, and less of tendency to partial accumulations, to irregularities in the circulation, and to high colored excretions. A late most ingenious author on the subject of dropsy has made the division into two kinds to hinge principally upon the circumstance whether the urine is loaded or not with serum; and, consequently, whether it does or does not evince a tendency to coagulate. We believe, however, that the distinction will generally be traceable with more accuracy by recognising other symptoms in combination with that of the urine, as marking the prevalence either of inflammatory action or lymphatic torpor; and establishing our principles of treatment upon this recognition. Besides the question, Is dropsy inflammatory or lymphatic? there is another point of moment to ascertain in regard to the rationale and management of all dropsical affections, viz. Is it organic, or is it general? In other words, does the effusion which forms the dropsical enlargement depend upon some local condition merely, of the part or viscus in which it is found, or is the local swelling an accidental and particular expression of general affection? On the diagnostic marks between encysted and other dropsies we shall soon say something further; it may here, however, be generally stated, that when the dropsical effusion is merely local, it most usually depends upon some accidental source of disturbance in the vessels of the affected viscus which may take place without any constitutional disposition to serous debility; but that when the swelling is of a more diffused and general kind we shall usually find, whatever may have been the exciting causes, that the actual disorder has been induced through the medium of that kind of habit which we may designate lymphatic, which if not actually the scrofulous temperament is at least nearly allied to it. Having made these preliminary remarks, on the rationale of dropsical production, we shall now proceed to treat more especially of ascites or dropsy of the abdomen.

Symptoms.—The existence of this complaint is for the most part unequivocally marked by protuberance on the belly, attended with fluctuation, perceived by placing the hand on one side of the abdomen, and gently striking on the opposite side. Dropsy of the abdomen may, however, exist, without any perceptible fluctuation.

Ascites is attended for the most part with scarcity of urine, with thirst, and some degree of fever, which usually, especially when it is of the lymphatic kind, partakes more or less of a hectic cast. Now it will readily be understood of what consequence it must be to ascertain the precise nature, both systematic and local, of the complaint, before we can set about forming any rational indications with regard to its treatment, or any correct opinions on the probability of its duration and event. Whether is it inflammatory? and if so, is the liver (the most usual source) or any other part or viscus the seat of the inflammation upon which it has depended? or is it lymphatic? In other words, does it originate in an undue torpor of the abdominal absorbents? Is it organic, merely? that is, does it arise out of the state of the organs concerned with primary reference to the condition of the whole body? or is it rather a mere local expression of general lymphatic weakness? If the first be the case, that is, if the complaint be inflammatory, we shall find more or less of tenderness upon placing our hands either upon the region of the liver, or upon the surface of the abdomen. We shall find the urinary excretion high colored rather than serous, and the fever will at first be rather of the usual pyrexial type, and only in the course of the malady will it come to put on a more decidedly hectic charater. If too, as is for the most part the case, the liver be the principal organ in fault, there will be present, more or less exquisitely marked, those characteristics which we have previously pointed out as belonging to liver affection, whether the disorder be inflammation, or schirrus, or mere congestion. If the dropsy be merely lymphatic, without any present or prior inflammation, it will for the most part be accompanied with œdematous swellings of an anasarcous kind in the legs and other parts, it will be without local pain or tenderness, and it will from the first have been signalised by a fever rather of the hectic than the common type. If the disorder be the result of some merely local inflammation, the inflammation of the part will have been of a decided kind, and often it will have depended upon some exterior or local cause. In each case the required treatment will vary, and saline, stimulant, or absorbent diuretics, will, according to circumstances, come to be employed with greater or less propriety and effect.

Prognosis.—The prognosis in dropsy of the abdomen will be always unfavorable if the disorder is accompanied by much indication of liver disorder, by marks of broken down stamina, and attended at the same time by the symptoms of slow inflammation going on in the peritonæal membrane.

Treatment.—What medicines, let us enquire, will it be proper to employ in case of inflammatory or congestive dropsy? Bleeding is recommended by some practitioners to a considerable extent, seeing that the effusion is brought about by the local plethora, and to lessen such plethora is thus to strike at the root of the disease. For the most part, however, we should be disposed to institute bleeding upon different premises, and consider it indirectly stimulant to the absorbent energies, upon the principle we have recently referred to as established by the experiments of Majendie.

Although we would by no means say that there may not be instances of inflammatory dropsy, in which a large use of the lancet may prove beneficial, we think it of moment to caution the unwary, in reference to bleeding, of the high probability of doing irreparable mischief by making too free with the loss of blood. It is in this kind of dropsy especially that the saline purgatives are of so much efficacy; and the supertartrite of potass, or crystals of tartar, hold justly a high consideration in dropsy of the belly accompanied by marks of lurking inflammation. In doses of a drachm, three or four times a day, this medicine will often act kindly upon the kidneys, and prove at once aperient, anti-inflammatory, and diuretic. The acetate of potass too, in doses of about

scruple or half a drachm, is a saline deobstruent in these cases of considerable efficacy; and even the subcarbonate of potass alone, especially when aided by much dilution, is a medicine of no mean virtue when employed with a view to its diuretic and antihydropic qualities. Its dose is about fifteen grains.

With respect to purgatives of a more drastic nature, which are recommended and used in ascitic cases, there ought to be some caution used lest we induce or rather increase the inflammatory disposition.

PURGATIVES.

℞ Pulv. Jalapæ ʒß.
Zingiberis ℈ß
Ol. juniperi ♏j.
Fiat pulvis: semel bisve in die sumend.

Take of powder of jalap half a drachm, of ginger half a scruple, oil of juniper one minim. Make them into a powder to be taken once or twice a day.

℞ Pil. hydrarg. ʒj.
Pulv. scillæ ʒß.
Extract. colocynth. ℈iiß.
Ol. juniper ♏xij.
Syrup q. s.
Fiat massa; in pilulas xxx divid., sumat ij ter ꝑ die.

Take of blue pill one drachm, powder of squill half a drachm, compound colocynth extract two scruples and a half, oil of juniper twelve minims, syrup enough to make into a mass, which divide into thirty pills, two to be taken three times a day.

There is one medicine which seems to operate almost with specific virtue in abdominal dropsy, and that is the elaterium (wild cucumber). While, therefore, we should be cautious in the administration of gamboge, or of scammony, in dropsies accompanied with hepatic inflammation, we should never hesitate in the employment of the elaterium, one grain of the extract of which, or in some cases only half a grain, acts often almost with the efficacy of a charm, and does not seem to be followed by so much debility as we might à priori be led to suspect. This medicine indeed seems to be applicable to either species of dropsical affection; and proves salutary, whether the serous effusions have depended upon mere lymphatic torpor, or have been brought about by chronic inflammation. It is to the lymphatic species of dropsy that the digitalis seems more especially applicable: and this fact, to which Dr. Blackhall alludes, would seem to establish the principle to which we have formerly adverted, respecting the stimulating quality of this medicine, when used so as to gradually act upon the absorbent system of vessels. Upon the whole, however, we are inclined to think that, where we require active measures in the way of procuring large and sudden evacuations, the foxglove must be thought of with considerable reserve, and it is certainly much more objectionable in the general way than the elaterium.

Among the more stimulant diuretics, applicable especially to the lymphatic species of dropsy, we may mention the lytta (cantharis). This substance requires of course attention to its progressive and peculiar effects; since improperly employed, or in too large doses, it is apt to prove the very contrary to a diuretic, and has been known actually to excite an inflammation in the kidneys. We have generally, for the purpose of preventing these probable consequences of the misuse of cantharides, been in the practice of combining with it another diuretic of a different class, but which can scarcely ever be objectionable, viz. the spiritus ætheris nitrici; about fifteen minims of the tincture of one, and thirty or forty of the other, with two or three drachms of mucilage of acacia, form a good and beneficial composition in many cases where we wish for the operation of a stimulant diuretic. Squill is another medicine of much reputed efficacy in dropsy; but perhaps more applicable to dropsy of the chest than of the abdomen. On oil of turpentine much praise has been bestowed by some practitioners, and tobacco has been also extolled. The meadow-saffron also, the colchicum autumnale, has been much praised both in dropsical and some other affections. The copaiba too is possessed of diuretic qualities and may be applicable to dropsy. Mercury also is a powerful remedy for dropsy, but we think with Dr. Blackhall it has been too often not only indiscriminately but mischievously used: such indeed is the power of this medicine upon the lymphatic and absorbent system, that it is not uncommon to see persons fall into a dropsical state after the liberal use of mercury, which may indeed partly depend upon the tendency this medicine has to excite internal erythematic inflammation, but is more especially attributable to the debility engendered in the lymphatic vessels by their being from mercury's protracted use kept in a condition of inordinate excitement.

Stimulant, saline, and absorbent diuretics, are the three divisions which may be made of these medicinals. And there certainly seems a foundation, in fact, for such division. Thus we have squill, we have lytta, we have turpentine, which appear to increase the flow of urine, either by a sort of direct or specific action upon the kidneys themselves, or by exciting such an action on the stomach, and such influence being propagated by the nerves to the kidneys. Saline diuretics, such as crystals of tartar, acetate of potass, carbonate of potass or soda, nitrate of potass, or nitre, are on the other hand supposed to be received into the circulation, and, passing off with the urine, to stimulate the vessels of the kidneys, and increase the quantity secreted. This mode of operation does not appear, however, quite satisfactory to the mind; and it certainly is not confined to the saline class of diuretics, since the copaiba and the turpentine, among the stimulant order of these medicinals, appear to be taken up into the circulation, and to pass off by the kidneys in this somewhat inscrutable manner. 'There is still perhaps another mode,' says a writer on the materia medica, 'in which certain substances produce a diuretic effect, and that is, by promoting absorption. When a large quantity of watery fluid is introduced into the circulating mass, it stimulates the secretory vessels of the kidneys, and is carried off by the urine. If therefore,' continues this writer, 'absorption be

promoted, and if a portion of serous fluid, perhaps previously effused, be taken up, the quantity of fluid secreted by the kidneys will be increased. In this way digitalis seems to act; its diuretic effect is said to be greater when exhibited in dropsy than it is in health.—Murray. Now it will be found useful to familiarise our minds with these various modes of operation in diuretic medicinals, since, as we have above seen, both their efficacy as diuretics, and their propriety of exhibition, are materially dependent upon the precise condition of the frame in which they are employed. We shall not again go over the ground of these distinctions and respective requirements, but shall content ourselves with saying, that in the lytta we have an example of the stimulant; in the acetate of potass of the saline; and, in digitalis, of the absorbent order of diuretics.

Before we quit the subject of the treatment which is requisite to disperse dropsical accumulation, it may be right to mention that the practice of tapping in abdominal dropsy is one which, both in reference to the time at which it is done, and the circumstances under which it is proper to do it, demands some discrimination: if performed very early, it may have proved an unnecessary interference; and, if deferred very late, it may not only add to the prevailing irritation, but be likely to produce an inflammatory affection of the peritonæum, which the patient, in his weak condition, will not be able to encounter. Although often of considerable temporary service, tapping can never be looked upon as a radical remedy; and, when we are convinced of much and extensive disorganisation of the liver, it is better for the most part to decline it. Puncturing or scarifying the thighs, when anasarca accompanies ascites, will often diminish even the abdominal tumor; and this last practice need never be objected to; but the application of blisters, to produce the effect of drain, may, in the weakened and irritable state of the body, give rise to sloughing sores.

Another important indication in dropsical affections remains to be spoken of, namely, how the re-accumulation is to be obviated. It is evident enough that such kind of diet should be selected for the individual as would prove nourishing without increasing irritation; and, when there is not any objectionable degree of irritation present, tonics are certainly called for; indeed, we are inclined to think that our vascular and inflammatory notions in reference to this, as well as to other diseases, forbid, to rather too great an extent, the exhibition of supporting powers, lest we should augment the inflammatory disposition. Let it be recollected how serviceable Peruvian bark often proves in erythematic inflammation, as in St. Anthony's Fire, occurring in certain conditions of the system; and let the analogy be acted upon with caution in reference to dropsical inflammation. The following observations on the bark and steel we extract from Dr. Blackhall. 'Perhaps practitioners,' says Dr. B., 'are too much in the habit of considering bark and steel as equivalent where tone is wanting. In the present disorder it is far otherwise, bark being to be preferred after dropsy of young persons, of acute disease, and of sound stamina; steel being suited to a vitiated rather than to a feeble habit, and indicated more by a pale sallow complexion, and want of red color in the blood.'

415. *Dropsy of the chest.* Hydrothorax.

Symptoms.—Difficulty of breathing, especially in a horizontal position, or upon more than common exercise; sudden startings from sleep; paleness of face, with occasional flushes of a hectic kind; starting out of sleep, with palpitation and oppressed breathing; numbness of the arms, or occasional pains in them; diminished urine and thirst; irregularities of pulse, and œdematous ancles.

The symptoms indeed vary according to the part of the chest implicated in the disorder; the effusion constituting the dropsy is sometimes confined to the pericardium, and in that case the patient is not so much inconvenienced by a horizontal position. Sometimes the subject of hydrothorax finds the impediment in breathing come upon him immediately upon lying down, at other times the dyspnœa is more gradual in its induction; and in this last case we may suppose the water to be rather in the substance of the lungs than in the cavity of the pleura, as the communication of the effused fluid is not so readily made from one to another portion of the cellular structure. When palpitation of the heart is a prominent symptom, we are generally disposed to infer that the effusion is principally into the pericardium. These irregularities of the heart occur, however, in consequence of the general obstruction to respiration and circulation that effusion into any portion of the chest supposes; and it is not easy to fix upon any one pathognomic symptom as indicative of one or another portion of the thoracic system being disordered.

Causes.—Hydrothorax, like ascites, may be the result of obstruction, or lymphatic debility, or membranous inflammation. It is very often symptomatic of other disorders, and not uncommonly connects itself with ascites. Its exciting causes are those which produce dropsy generally. Long continued asthma gives a tendency to, and often terminates in, hydrothoracic effusion.

Diagnosis.—The accompanying dropsical indications, such as œdema of the ancles, and paucity of urine, and thirst, generally distinguish hydrothorax from mere dyspnœa; than these last two hydrothorax is in the general way more permanent and less intermitting. The fluctuation externally, of which systematic authors speak, can very seldom be detected, even when the fluid is in the thoracic cavity. When fluctuation is perceptible it is generally matter or pus which causes it, and this the result of active inflammation on the chest.

Prognosis.—When much organic disease, or any change of structure, has induced the ailment, the prognosis is for the most part unfavorable; and it is seldom that the malady is permanently overcome when it may have resulted from chronic and insidious inflammation. We ought always to be guarded in our prognosis, even when we suspect fluid in any part of the thoracic cavity; for it is very often that the patient under these circumstances dies suddenly: a mere turn of the body will occasionally extinguish life.

Treatment.—Squill and foxglove seem more especially adapted for water in the chest, as elaterium seems applicable to abdominal dropsy, and with these small quantities of mercury are to be added should there be any attendant symptoms denoting hepatic affection.

℞ Pulv. digitalis purp.
Pulv. scillæ, āā gr. xv.
Pil. hydrarg. ℈j.
Camphoræ ℈ij.
Ol. juniperi ♏ viii.
Syrupi q. s.
Fiat massa; in pilulas xxx. dividenda. Sumat ij ter in die.

Take of powder of foxglove and squill of each fifteen grains, blue pill a scruple, camphor two scruples, oil of juniper eight minims, simple syrup enough to form a mass, which divide into thirty pills. Two to be taken three times a day.

℞ Tinct. cantharid. ♏ xij.
Sp. ætheris nitrici ʒj.
Mucilag. acaciæ ʒiij.
Mistura camphoræ ℥iss.
Fiat haustus; ter in die sumendus.

Take of tincture of cantharides twelve minims, nitric spirit of ether a fluid drachm, mucilage of acacia three fluid drachms, camphor mixture a fluid ounce and a half. Mix for a draught. To be taken three times a day.

℞ Myrrhæ ℈ss.
Ol. juniperi ♏ ij.
Pulv. rhei gr. vj.
Syrup. simp. q. s.
Fiat bolus; ter in die sumendus.

Take of myrrh ten grains, oil of juniper two minims, powder of rhubarb six grains, simple syrup enough to make into a bolus. To be taken three times a day.

℞ Tinct. colchici f. ℥ss
Syrupi aurantii f. ℥ss.
Fiat syrupus cujus; sumat æger cochleare minimum subinde, donec nauseam promoveat.

Take of tincture of meadow saffron a fluid half ounce, syrup of orange peel a fluid ounce and a half. Make them into a syrup; of which let the patient take a tea spoonful frequently, until nausea be produced.

416. *Water in the head.* Hydrocephalus.—Dr. Cullen is remarkably defective in his pathological account and systematic arrangements of encephalic affections. The water in the head, to which he alludes in this part of the nosology, is that congenital kind which some authors have described as the external, to distinguish it from that which is the result of a morbid action, which occurs after birth, and where the effusion by which the malady is constituted, or rather by which it is terminated (for the actual disease often exists long prior to the effusion) is principally found in the ventricles of the brain.

The only notice which he takes of this last affection is under the head of apoplexy; where the student, by turning to the nosology, will find the hydrocephalic apoplexy marked as one of the genera, and defined, apoplexy coming on by degrees, attacking children, and individuals under the age of puberty, attended by febricula, and pain in the head, which is succeeded by a pulse slower than natural, a dilated pupil of the eye, and drowsiness.

The fact is that there are several ways in which effusion is effected upon the substance or in the ventricles of the brain, one of which constitutes the hydrocephalus of the present genus; which, as we have above remarked, is a congenital disorder; the process of ossification does not go on as in other children, but the head, large at birth, continues to increase; the faculties, instead of gradually developing themselves as in other children, are irregular in their manifestation; and, sometimes, with a generally idiotic condition of intellect, the patient will manifest some one particular faculty or sentiment, even in a more than ordinary measure. We recollect one remarkable instance of this kind of hydrocephalus, in which the ear for music was extraordinarily nice and delicate. While the head enlarges the limbs continue small and powerless; and should the child survive it is obliged to be carried about, often even at an advanced age, from want of power and growth of limb.

Sometimes this disorder becomes spontaneously cured; at other times the head continues of an enormous size; but the bony process after a time becomes complete, and the patient lives for some years with a diminutive stature and defective intellect; for the most part, however, it terminates fatally. When it only exists to a certain extent it has seemed to us occasionally to yield to medicinal treatment given with a view to act upon the absorbent system. And, even on the day that we are writing these remarks, we have seen the parent of a child who was the subject of this disorder, and whose life was not expected by the parents, but who is now a strong and lively child. Dr. Good mentions the case of an hydrocephalic subject of this kind having a grain of calomel given to it for a length of time every day; and he states that the individual is now a student at one of the English universities. Our own plan of treatment is that of administering very small doses, gradually repeated, of tincture of digitalis combined with the hydrarg. cum cretâ, as mentioned under the head of *Tabes*. Lately the water has been discharged by a puncture at one of the sutures, in more decided cases of hydrocephalus externus, and a bandage applied so as to promote absorption and prevent re-accumulation. But in most instances, to say the least, the effusion has returned in spite of all precautions to obviate it.

There is a second kind of hydrocephalus which is only congenital in its tendency; that is, an infant is born with a decidedly strumous constitution; it is perhaps injudiciously fed and nursed; the mesenteric system of vessels become disordered; irregular chylification is the result. From this irregularity in the supply of nutritious matter, together with the inordinate stimulus to which the infant is subjected, the brain becomes inordinately excited, now being too much and now too little stimulated; slow insidious alterations in consequence occur; the gradual and orderly process of development is interfered with, and hydrocephalus steals upon the child

insensibly. This kind of disorder too is remarkably under the influence of deobstruent mercurials and small doses of foxglove, as alluded to just now under the head of external hydrocephalus.

There is what is called the water-stroke, in which the effusion is made as if by a sudden rush, and which seems to be the result of the exhalants all at once giving way, for want of power to perform their functions properly. In this case the marks of effusion, such as squinting and paralysis and convulsions, come upon the child at times almost instantaneously; and this species of hydrocephalus very frequently is metastatic, that is, some other disorder has existed perhaps for some length of time, it suddenly yields, and in its place this brain affection is thus induced.

For the most part this kind of hydrocephalus is out of the reach of remedy; if any thing may be expected from medicine, it is from those substances which should excite a large discharge from the emunctories, more especially from the kidneys, and thus cure the complaint by a sort of artificial metastasis; but we repeat that very little is to be looked for under these circumstances, of perhaps broken-down frame by a previous disease, and a large effusion into the ventricles of the brain. Occasionally we shall find, however, that symptoms of oppressed brain, as if from the source now supposed, will suddenly be induced, and examinations after death will not justify our previous conceptions of the disorder's precise nature. The last case we witnessed of this kind, of seeming water-stroke, was in the child of a physician, who appeared to be recovering from a violent attack of inflammation of the chest, connected with the virus of hooping-cough: this promised amendment was suddenly and unexpectedly succeeded by marks of compressed brain, as if from effusion, but upon post mortem inspection very little cerebral lesion of any kind was discoverable.

These different kinds of hydrocephalus are all for the most part indices of scrofulous habits; but there is a fourth species, which is not confined so much as in the other cases to one particular kind of constitution. It is still however of more ready occurrence in such as have a tendency to lymphatic debility. Although most frequent in children under twelve years of age, it is sometimes observed in adults. It has been divided by Dr. Whytt, and others who have followed him, into three distinct stages; the first of which is invariably characterised by a pulse of increased quickness and comparative strength; in the second the pulsations become slower and more feeble; in the third and last stages the rapidity is increased beyond even that of the primary stage; but this increased action is now attended with extreme debility. These different changes in the circulation are not however always to be traced even in the acute or phrenitic species of hydrocephalus, in that order and undeviating regularity which the observations of Dr. Whytt would lead the young practitioner to imagine, although it is a disorder of much greater regularity than the other. Obscure affections of the stomach, and a general feeling of febrile lassitude, are often the precursors of the first or inflammatory stage of acute hydrocephalus. At other times feverish heat, intolerance of light, violent pains in the head, and vomiting, are the earliest signs of the disorder, to which the attention of friends is called. These symptoms, Dr. Rush tells us, are frequently attended with a remarkable impatience of sound; and, although we have not much observed this, it is easy enough to conceive, when the seat of the inflammation is about that part of the brain more particularly which is connected with the auditory nerves. The pain of the head is often confined to one side; and, in proportion to its intensity, the nausea and vomiting become less urgent, while, with the remission of the pain, these symptoms are disposed to recur. Respiration is sometimes at this period of the complaint spasmodic and irregular, the bowels are often so costive as to require strong doses of purgatives, in order to procure evacuations; at other times a diarrhœa is present. This stage sometimes lasts for several days; it is then succeeded by the second, which commences by a sudden reduction of the pulse, and other symptoms of irritation. The pain of the head now becomes less acute, and in some measure changes, not merely its degree, but its kind; torpor and insensibility to light succeed to watchfulness and visual irritation; the child now lifts his hands to his head (this symptom indeed is often present in the first stage, though not so observable); he now frequently utters piercing screams; strabismus, or squinting, in a degree takes place; an invincible inclination is shown to a horizontal posture, and to having the head particularly low; and there is a motion of the head from side to side, and a desire to throw the head back when the child is lifted up, which are both remarkably characteristic of effusion upon the brain; the bowels still continue torpid; and after these symptoms have continued for some days, perhaps a week, more or less, the complaint very often seems to be on the decline; deceitful semblances of returning health are noticed, so much so indeed, that parents, and even practitioners, are sometimes induced to think that either nature or medicine has begun to operate a beneficial change. There is less irritation, less fever, the beats of the pulse become more regular, and the child evinces a disposition to rouse himself, and notice sur rounding objects. This semblance, however, o amendment is but a prelude to the final perio of the disorder. It commonly lasts one or tw days, and then the pulse, suddenly almost, be comes again very rapid, so much so indeed, tha it is often not to be counted. Dr. Whytt tel us that he has been able to number 210 pu sations in the space of a minute; this extrao dinary rapidity does not however, as in t quickness of the first stage, last through t whole of the day: it comes on and declines wi the accessions and remissions of the hectic flu in the cheek. The eyes at length become inse sible to the strongest light; convulsions sup vene, and life is terminated. The duration this last period like that of the others is irre lar. Sometimes the patient is carried off

a few days from its commencement; at other times the child lingers in a hectic and convulsed state for some weeks; and Dr. Monro has informed us, that the last stage has been known to be protracted even to the fourth month. In the general way, however, the whole period of the malady, from its commencement with inflammatory irritation to its termination in hectic, convulsions, and death, is less than a month. The lymph which is thrown out upon the brain is found for the most part to be coagulable, proving the disorder to have been in the first instance inflammatory.

Distinctions.—As the hydrocephalus is very frequently present when not suspected, as it is often on the other hand suspected when not present, and as it is always of much moment to distinguish as early and as precisely as possible between this and other affections with which it has a deceitful resemblance, we shall here point out the leading features of difference between it and one or two other of childrens' disorders, but the possibility ought always to be recollected of one of these complaints running into the other, and that they exist often conjunctively. Worms, difficult dentition, tabes mesenterica, and that kind of irritation which has been denominated infantile remittent fever, are the particular affections that have sometimes been suspected, and at other times commuted for true hydrocephalus internus.

When the state which we apprehend to be hydrocephalic, arises from worms, there has for the most part during the whole of the indisposition been more of a dull heavy pain in the head than that acute sensation which often characterises the first stages of hydrocephalus. In worm cases there is never found that irritability to the light which likewise in a great number of instances marks the first stage of hydrocephalic irritation. On the contrary, the pupil of the eye, from first to last, is large and inirritable when the disorder is occasioned by worms. It is not uncommon too for the pain in hydrocephalus to be distinctly seated on one or the other temple, while the pain occasioned by the presence of worms is indistinct and hardly referrible to one more than to another part of the head. As a characteristic of worms, we frequently find a tumid thickness in the upper lip, or the whole space between the nostrils and the margin of the lip; there is too almost invariably an irritation in the membrane of the nostrils, which inclines the little patient to be constantly picking or rubbing the nose. This species of irritation is by no means common to the hydrocephalic state. When worms are present the appetite is for the most part extremely irregular; now voracious and hardly to be satisfied, and now more than commonly delicate; but in the hydrocephalus, in the early stages, and even during the whole of the complaint, there is for the most part an indifference about taking food. In instances of worms there is often a tumefaction about the abdomen, as well as in the upper lip—this is not usual in hydrocephalus. Further, worms often occasion the stridor dentium, as it is termed—grating of the teeth in sleep, and even convulsive or epileptic fits, neither of which affections is observed in dropsy of the brain, excepting in its final stages. Lastly, in cases of worms, there never is any thing of that order and succession of symptoms, which we have pointed out above, as not unfrequently seen in hydrocephalus; first, of irritation; secondly of a sort of exhaustion, or apoplectic oppression; and, thirdly, of a still greater irritation as preliminary to death.

Difficult dentition not only often gives rise to symptoms very similar to hydrocephalus, but very frequently actually produces it—the inflammatory irritation which it excites extending itself from the gums to the brain. When, however, the state is merely that of teething irritation, the gums and mouth are for the most part hot and inflamed; the bowels, though irregular, are more easily acted on than when the brain is actually affected, and that symptom of extreme susceptibility to light in the first instance, and subsequently of torpor, or of squinting, is not attendant merely upon teething. From tabes mesenterica, hydrocephalus is to be distinguished by the absence in the latter of that tumefaction and knottiness in the abdomen which is, as we have before stated, the grand characteristic feature of the former. In tabes mesenterica, too, the attendant fever is from the first rather of the hectic than of the common kind, while the first stage of hydrocephalus is very often marked more by ordinary febrile irritation. There is always too, and necessarily, a wasting of the flesh to a great degree, consequent upon the deprivation of nutriment to the blood, in the mesenteric atrophy; but the hydrocephalic patient will often go through the whole course of the complaint with comparatively little reduction of flesh or strength; since it is possible for the brain to be very extensively diseased, and the process of chylification nevertheless to proceed without much interruption. Lastly, that disordered state which has received by authors the denomination of bilious remittent, or infantile fever, very frequently assumes an appearance which gives rise to suspicion that all is not going on well in the head; and indeed this suspicion is not unlikely to be well-founded, for we would wish again and again to impress the possibility of one complaint falling by almost insensible gradations into the other. There are, however, certain diagnostic marks between the one and the other affection, and these have been so well detailed by Dr. Pemberton, in his work on the Diseases of the Abdominal Viscera, that we shall make use of his words in pointing them out:—'In hydrocephalus internus,' says Dr. P., 'there are occasional screamings in the sleep, with a continual tossing of the hands above the head, and an intolerance of light, with more or less of squinting; but I think I may say that, in the complaint before us (remittent fever), there is hardly ever what can be called screaming, and there is seldom intolerance of light, and never squinting; and moreover, though the hands are often carried to the face, it seems more from an inclination to pick the skin from the lips, eyes, and nose, than occasioned by the painful restlessness which attends hydrocephalus. In the delirium of hydrocephalus, the faculties are totally destroyed, and the muttering ravings of the patient are without sense or reason, and from this

state he cannot be roused. But in the other species of delirium the child, during this state, can at any time be recalled to his senses, which he will retain for a few minutes, acting and talking consistently. In remittent fever the appetite is destroyed; in hydrocephalus, on the contrary, the patient will take, without reluctance, whatever is offered, apparently making no distinction between what is palatable and what is nauseous. This difference of the appetite in the one and the other complaint is a most important feature of distinction between the two maladies.'

Dr. Pemberton would have done well to add, that the wasting of flesh is not so evident as in remittent fever. Upon this difference we have just observed in marking the diagnosis between tabes mesenterica and water in the head; and we have often been struck with the remark of parents and attendants about an hydrocephalic patient, 'that, considering he is so very ill, he has not lost much flesh;' a circumstance which, while it gives birth to hope on the part of friends, ought at least to excite suspicion in the medical attendant. The excretions of the bowels are sometimes perfectly black, and smelling like putrid mud; they are sometimes curdled with shreds of coagulating lymph, floating in a dark greenish-colored fluid. These appearances of the fæces are not observed in hydrocephalus internus.

'The convulsions,' the author goes on to say, 'which attend hydrocephalus, very seldom supervene, until the patient has been laboring for several days under evident indisposition, whereas they often usher in the very first attack of remittent fever.'

Causes.—Too much has been probably attributed in the present day to the state of the stomach, the bowels, and the hepatic viscera, as the media through which the affection now under remark is engendered; for though hydrocephalus is confessedly often a sympathetic malady, occasioned by the visceral irregularities in question, it is full as often, to say the least, an originally cerebral disorder, and the intestinal irregularities by which it is attended stand more in the relation of effect than cause of the brain disease. Even indeed when hydrocephalus is induced indirectly, through the medium of other affections, it is mostly so engendered by the affections of the absorbent system which commence in the mesentery, and extend as it were to the brain, rather than by those mechanical kinds of obstructed viscera which are chiefly supposed to be in fault.

In confirmation of this opinion, that hydrocephalus frequently commences in the head and not in the viscera, we shall repeat here the few positions that we have elsewhere urged for the purpose of establishing this assumption. First: We find the disease to be one principally of early life. It occurs ordinarily at some period during the growth and gradual evolution of the brain, before the organ has arrived at maturity, which circumstance would seem to favor the supposition of some organic alteration taking place of an original and independent nature; for impediments and interruptions must naturally be more incident to an organ during the process of development, than after the evolution is complete. Secondly: The malady is often connected with, and seemingly produced by, the process of teething, the irritation of which appears to extend itself to contiguous parts, and the brain comes to be affected by actual vicinity of position without reference to a distant organ. Thirdly: Were the complaint always, or more usually, brought about by obstructed viscera, we should expect to meet with it oftener in advanced life, when such obstructions are both more common, and more permanently operative, and then most obviously engender disorders in distant parts of the frame. Fourthly: We may observe that the subjects of hydrocephalus are, in the majority at least of cases, subjects in which a scrofulous tendency in the habit is more or less perceptible; and they are moreover those children in whom, from a precocity of intellect, we might expect brain functions to be inordinately active and complicated, and consequently more susceptible of disordered action.

But further; the frequently obvious causes of hydrocephalus are proofs of a too certain nature, that the complaint may, and often does, originate directly in the head. It has been suggested, by Dr. Wall of Oxford, whether the increased frequency of hydrocephalus of late years may not be traced to 'the leaving off the circular defence round the heads of children,' and their consequently more frequent exposure to injury from falls and blows. Whether this be the case or not, certain it is, and no practitioner of any experience will be inclined to dispute the truth of the statement, that external injuries, directly applied to the head, are often the immediately exciting sources of the disease; and this perhaps is the case much oftener than is seen or suspected. When the derangement has been thus certainly induced, in an immediate and direct way, we always see the functions of the bowels to be disordered in consequence; and may not this incidental and secondary affection be often in other cases taken for the cause, when it is rather the consequence? the torpidity or irregularity of the bowels being occasioned by that altered state of the brain, which is prior to the actual production of confirmed hydrocephalus. 'Anatomical dissections,' says Dr. Spurzheim, 'have convinced me, that in the greater number of cases the morbid appearances of the abdomen are secondary symptoms to those of the head.'

We, however, by no means wish to push our objections to the sympathetic theory too far. Derangements in the digestive organs, if permitted to go on without interruption, do often proceed to the length even of phrenitic hydrocephalus; and attention to the bowels in children with a view to prevent this result is highly important. In these instances, however, of secondary or resulting affection, we hold for the necessity of the scrofulous tendency being present to produce this specific effect; such tendency may not be very marked, but still it does exist: and upon the whole we would say, in reference to exciting cause, that dentition is the most common source of the disease, but that in the predisposed it may be engendered by almost any thing which shall disturb the balance of healthy functions.

Prognosis.—Exceedingly unfavorable. It is indeed questionable whether recoveries ever take place after effusion has been thrown out into the ventricles in any considerable quantity. Many, indeed, are the cases on record in which after the full trial of the mercurial plan, hydrocephalus in its very last stages has been cured; but there is always some reason to suppose that mistakes may have been made in reference to the actual condition of the brain supposed thus to be counteracted; for marks indicative of effusion o a considerable extent are, as in the case above elated, often present during life which are not manifested after death. We are disposed to think, when either art or nature does succeed in getting rid of the effused fluid, that a large flow of urine, or a very free diaphores, or a considerable diarrhœa, must be expected in the way of vicarious effect.

Treatment.—During the inflammatory stage bleeding and purging are to be had recourse to; but we must ever recollect that, notwithstanding the measure of inflammatory irritation, there is present a scrofulous debility which should in some degree stay the hand of depletion. Elaterium as a purgative appears applicable to the first stages of phrenitic hydrocephalus, since it produces a feeling of nausea, as well as occasions catharsis; and in this way absorption may perhaps be assisted. We rather wish, however, that the recommendation of elaterium should be received as a matter of experience, than upon any hypothesis as to its modus operandi. It scarcely need be stated that very small doses will be sufficient for a child, such as the sixth part or a quarter of a grain. Dr. Hooper recommends the croton oil, which has this advantage, that it can be put upon the child's tongue and thus brought to operate. We recollect seeing a child's life saved by merely smearing the tongue with the moistened cork from a croton oil bottle, and this after the power of deglutition, at least of swallowing any thing in much bulk, was gone. Digitalis and nitre may be administered to abate the febrile irritation and get down the inflammatory excitement.

℞ Pulv. potassæ nitrat. gr. vj.
Tinct. digitalis ♏ v—x.
Liq. ammon. acet. f. ʒij.
Syrup. croci. f. ʒj.
Aquæ distillatæ f. ʒv.

Fiat haustus; infanti ætat 4, adhibendus tertiâ quaque horâ.

Take of powdered nitre six grains, tincture of foxglove from five to ten minims, liquor of acetated ammonia two fluid drachms, syrup of saffron one fluid drachm, distilled water five fluid drachms. Make them into a draught for a child of four years; to be taken every third hour.—*Hooper.*

℞ Hydrarg. cum cretâ gr. ij.
Pulv. digitalis gr. ß.

Fiat pulvis; ter in die sumendus, ex quovis vehiculo crasso.

Take of quicksilver with chalk two grains, powder of foxglove half a grain. Make them into a powder to be taken three times a day in omething thick.

When the inflammatory stage is a little over, and even from the first showings of the disease, some practitioners commence immediately with mercury, under the notion that nothing else is to be depended upon. We wish we could conceive as favorably of the efficacy of this treatment as some practitioners seem to do.

℞ Hydrarg. submur. gr. ij.
Pulv. antimonialis gr. j.

Fiat pulvis, omni bihorio adhibendus ex quovis vehiculo crasso.

Take of calomel two grains, antimonial powder one grain. Make them into a powder, of which let one be taken every second hour in any thick vehicle. Anoint with mercurial ointment under the arms and in the groins.

Some have reported favorably of the effect of tinct. cantharid., and have joined deobstruents with it.

℞ Extract. taraxaci ℈ß.
Spiritûs ætheris nitrici ♏ xv.
Tinct. cantharid. ♏ iv.
Syrup. simp. f. ʒj.
Aquæ puræ f. ʒiiß.

Fiat haustus.

Take of extract of dandelion ten grains, nitric spirit of ether fifteen minims, tincture of cantharides four minims, simple syrup a fluid drachm, water two fluid drachms and a half. Make them into a draught.

Blisters may be applied to the nucha, but much is not to be expected from them. When there is much exterior heat about the head lotions may be applied, formed of spirits and water, or a solution of the muriate of ammonia, or vinegar and water.

It is often necessary to give opium to abate the irritations, and the best form of administering it under these circumstances is that of the pulv ipecac. comp., which may be combined with a small quantity of calomel. It is a fact worth attending to, that opium, in this form, will be borne by children when other preparations of it are inadmissible.

℞ Pulv. ipecac. comp. gr. ij.
Hydrarg. submur. gr. ¼.

Fiat pulvis; horâ somni sumendus.

Take of compound powder of ipecacuan two grains, calomel a quarter of a grain. Make them into a powder to be taken every night at bed time.

418. *Dropsy of the womb* (hydrometra) should rather be stated dropsy of the appendages of the womb, the ovaria (hydrops ovarii); for the collections in the womb itself, which give rise to the symptoms named in the definition, are not very common, unless as a consequence of false conception; in this case we have occasionally hydatid and other accumulations formed in the uterus, and retained by the production of an adventitious membrane or membranes.

Ovarian dropsy is of more frequent occurrence, and this it is sometimes difficult to distinguish from general dropsy in the abdomen. Of this affection Boerhaave, in one of his aphorisms, says, difficulter cognoscitur, curatur verò nunquam. It attacks usually women at the time when the menstrual discharge is about to leave them, and

is most usually an affection of virginity or barrenness. This however is by no means universally the case; for we sometimes observe it to occur in females at the prime and vigor of life, and at the very time in which they are regularly conceiving and becoming pregnant. Although, as we have just said, a dropsy in one or other of the ovaria is not easily to be distinguished from a dropsical affection in the cavity of the abdomen, yet there are certain diagnostic characters between the one and the other disease, which it behoves the medical practitioner constantly to bear in mind, since it is often of much moment with regard to practice, and always as it relates to prognostic inferences, to judge correctly respecting the position and actual nature of the dropsical swelling. In the first place, then, let it be remembered that, although in the event the whole surface of the abdomen becomes almost equally tumefied by ovarian dropsy, at the commencement of the enlargement this swelling is decidedly more on one side than the other, which is not the case in abdominal dropsy or ascites. The enlargement is, secondly, more slow in its progress than in cases of ascitic swelling. There is, thirdly, for the most part, no œdematous swelling about the ancles and legs, which is a frequent concomitant of ascites; or, if this swelling do occur, it is more in one leg than in the other, and in this case the enlargement of the limb is more decided, extensive, and continued, than in the case of general œdematous tumefactions. Fourthly, the general health is not by any means impaired in proportion to the extent of the local disorder, as is the case in ascites. In the fifth place the urine is not, as in ascites, in particularly small quantities, until the bulk of the swelling becomes such as to impede the proper actions of the urinary bladder, and in this case it is rather a mechanical interruption to the discharge than any deficiency of secretion. Sixthly, thirst is by no means so urgent as it is in dropsy generally. Seventhly, there is an absence of those liver affections, and of that peritonæal tenderness, which we have before pointed out as very common concomitants of ascites, especially in advanced life; and, lastly, the fluid cannot so distinctly be perceived to fluctuate as when it lies loose in the abdomen, and constitutes the true ascites. There is a further distinction to be observed even in regard to the ovarian dropsy itself, namely, Is the fluid which is contained in the organ extended throughout its whole cavity, thus constituting one uniform cyst? or is the ovarium, converted into a congeries of small, complete, and independent cysts? This distinction it will be of practical consequence to aim at tracing, since an operation in one case to discharge the collected fluid might prove of considerable temporary service, whereas in the other case, that in which the cysts are numerous and independent of each other, a very small quantity of fluid might be evacuated only from the puncture, and the patient would scarcely receive even immediate and partial relief from the introduction of the instrument. The principal and almost only mean of à priori distinction in this case is, to pass the hand over the whole surface of the abdomen, and endeavour to perceive whether the tumefaction is uniform, and without irregularities; if not, and there are on the contrary protuberances and irregularities in the swelling, it will be fair to presume that the water is contained in separate cysts or cavities, each of which must be punctured before the fluid can be evacuated. 'These cysts,' says Dr. Baillie, 'have been occasionally confounded with hydatids (another disease to which the uterus is more especially subject), to which they bear some resemblance. They are however really very different. They have much firmer, and less pulpy coats, than the hydatids; they contain a different kind of fluid, and they are differently connected among themselves. Hydatids either lie loose with regard to any connexion with each other, or they enclose each other in a series; or small hydatids adhere to the coats of larger ones. Cysts of the ovarium adhere to each other laterally by pretty broad surfaces; do not envelope each other in a series; and appear to have no power analogous to generation like hydatids, by which small cysts are formed, that are attached to those of a larger size.' It appears not improbable that these cysts are formed by a gradual enlargement of the small vesicles which make a part of the natural structure of the ovaria. On the treatment of ovarian dropsy we have literally nothing to say. It is probable that the state of the organs, previous to the collection of fluid, is of an irremediable nature; certain it is, however, that we have no well authenticated cases of any actual absorption of the fluid, and reduction of the ovary to its natural state, by means of medicinals of any kind. Tapping is a temporary remedy when the cyst is single, and it is perhaps more likely to be attended with unexceptionable benefit in some cases than even in general dropsy of the abdomen, since the tendency to peritonæal inflammation is not so great, the malady being of a more topical, and less complicated nature. Professor Morand asserts that he several times performed this operation on a lady of quality, who suffered so little from it, that she frequently went into the country the day after the operation, although generally eighteen pints of water were drawn out; nor did she die at last of dropsy, but of some other disease.

It should be observed that although an ovarian enlargement is for the most part a dropsical affection, it is not so without exception. There is a species of schirrous increase in the bulk of one of the ovaria sometimes to be met with: this however, compared with ovarian dropsy, is most certainly a rare occurrence, and the complaint in such a case would be attended with more derangement of the general health than is found to be the case for the most part in dropsy of the ovaria. The swelling too would be less in bulk and more gradual still in its progress. We may remark, indeed, that the ovaries are obnoxious to several disordered conditions of an anomalous nature, and all, we believe, without remedy. Boerhaave and others talk of fomentations, and vapors, and the warm emmenagogue drugs, &c. but we are disposed to think that, when the patient recovers, we are more indebted to nature than to art for the performance of the cure.

Although this is not exactly the place to speak

of them, we may here take occasion just slightly to glance at those anomalous affections that are connected with the cessation of the menstrual discharge: we might go the whole round of diseases before we should exhaust this subject. The fact is that there are no constitutional affections but what are likely to make their appearance at this proverbially critical time in the life of a female. Thus gout, apoplexy, mania, asthma, dropsy, stomach and intestinal complaints, ulcers in the legs, and many other distempers, seem as it were to await this time to make their attacks on the constitution, 'hanc nacta occasionem,' as Dr. Heberden elegantly expresses it, 'de valetudine jam infirma facile triumphant, et stabile imperium constituunt.' As it relates to the treatment of these maladies nothing requires further to be said, in reference to their appearance at this particular period, than that the management of them should always have an especial view to the stoppage or not of the menses; and that local evacuations apportioned to the vicarious congestions induced are often demanded, not in order to lessen general plethora, but for the purpose of diminishing topical fulness or inflammation. Thus supposing a menace of apoplexy to occur, upon the sudden disappearance of the monthly discharge, we should be called upon more imperiously to detract blood from the vessels of the head than in common cases of the same disorder at an advanced period of life; and purgatives especially are almost without exception called for in instances of this nature. The drying up too of ulcers, or the precipitate stoppage of natural evacuations, must in the state of things be very guarded and gradually done, and in fact the general principles of treating diseases at this juncture is that which the disciples of the Boerhaavian school of medicine would call deobstruent.

419. *Anasarca.* Dropsy of the flesh.—Before quitting the subject entirely of dropsical affections we are called upon to say that a mere dropsy of the flesh sometimes occurs without being accompanied by any visceral disorder—for the most part, however, it is the result of or attendant upon these last, and constitutes merely one of the marks of an exhausted frame and interrupted circulation. On this head we shall again make use of Dr. Hooper's instructions by extracting the section of his book which relates to it, and this we are induced to do from the opportunity it will afford us of presenting to the English reader the numerous prescriptions which are given by Dr. H., and which it may be observed are applicable in most cases to other kinds of dropsical accumulations as well as those for which they are more particularly inserted.

Symptoms.—The disease generally commences in the lower extremities, and first shows itself towards evening with a swelling of the feet and ancles, which by degrees ascends, and successively occupies the thighs and trunk of the body. When it has become very general the viscera are affected in a similar way; the cellular membrane of the lungs partakes the affection; the breathing becomes difficult, and is accompanied by cough, and the expectoration of a watery fluid. The urine is small in quantity, high colored, and deposits a reddish sediment; sometimes, however, it is of a pale whey color, and more copious. Costiveness; insatiable thirst; the skin is generally pale and arid; though sometimes a slight yet general inflammation takes place, when it becomes tense and shining. The water often oozes through the pores of the cuticle, or raises it in the form of small blisters; the countenance becomes sallow; torpor; heaviness, troublesome cough; slow fever.

Causes.—Predisposing. An hydropic diathesis, which is known by a loose flabby fibre, pallid and bloated countenance, the phlegmatic temperament, and scanty secretion of urine.

Exciting. Certain organic diseases, producing an obstruction to the free circulation of the blood; excessive discharges; suppression of customary evacuations; exposure to a moist atmosphere; the sudden striking in of eruptive complaints; crude and indigestible aliment; drinking large quantities of watery fluids; abuse of spirituous liquors; certain preceding diseases, as inflammation, the exanthemata, especially scarlatina; jaundice, diarrhœa, dysentery, phthisis, gout, intermittents of long standing.

Proximate. Increased effusion; diminished absorption; or both united.

Distinctions.—From emphysema. By the swelling in anasarca being œdematous; in emphysema, elastic and accompanied with crepitus; by the particular state of the urine; and other symptoms above mentioned.

Prognosis.—Favorable. The disease having been induced by causes which admit of easy removal; the strength little diminished; the constitution of the patient previously unimpaired; the appetite remaining entire; the respiration free; no great thirst; a gentle moisture on the skin.

Unfavorable. Concomitant organic disease; great emaciation; erysipelatous imflammation; much drowsiness; petechiæ and ecchymoses; hæmorrhage; feverish heat; great thirst; quick small pulse.

Treatment.—Indications. 1. To evacuate the collected fluid. 2. To prevent its again accumulating.

The collected fluid is evacuated by,

1. Scarifications and punctures.
2. Blisters.
3. Friction.
4. Emetics, and nauseating medicines; especially antimonium tartarizatum and squills.

℞ Vini ipecacuanhæ f. ℥ß.
Tincturæ scillæ f. ʒij.
Fiat haustus emeticus.

Take of Ipecacuan wine a fluid half ounce, and tincture of squill two fluid drachms. Make an emetic draught.

5. Cathartics; of elaterium—gamboge—croton oil—jalap—colocynth—submuriate of mercury—gratiola—crystals of tartar

℞ Extracti elaterii gr. ij.
Sacchari purificati ʒj.

Optime terantur simul, dein in pulveres octo æquales dividantur, quorum capiat æger unum omni horæ quadrante donec adsit catharsis.

Take of elaterium two grains, purified sugar a

drachm. Let them be well rubbed together and divided into eight equal parts, and let one be taken every quarter of an hour till they operate by the bowels.

℞ Extracti colocynthidis compositi
Extracti jalapæ, āā ʒj.
Gambogiæ ℈ß.
Olei juniperi ♏iv.

Fiant pilulæ xij. quarum capiantur tres omni hora donec alvus ter quaterve respondeat.

Take of compound colocynth extract and extract of jalap of each a drachm, gamboge ten grains, oil of juniper four minims. Make the mass into twelve pills, of which let three be administered every hour until three or four evacuations by the bowels are produced.

℞ Hydrargyri submuriatis gr. v.
Confectionis rosæ q. s.

Fiat pilula mane sumenda cum haustu cathartico salino.

Take of calomel five grains, conserve of roses sufficient to make a pill, to be taken in the morning with a saline cathartic draught.

℞ Pulveris scammoniæ compositi ℈ß.
Hydrargyri submuriatis gr. v.

Fiat pulvis catharticus.

Take of compound powder of scammony ten grains, calomel five grains. Make them into a cathartic powder.

℞ Extracti gratiolæ gr. xv.
Tincturæ sennæ f. ʒij.
Infusi sennæ f. ʒxj.
Syrupi zingiberis f. ʒij.
Potassæ sulphatis ℈j.

Fiat naustus catharticus.

Take of extract of hedge hyssop fifteen grains, tincture of senna two fluid drachms, infusion of senna eleven fluid drachms, syrup of ginger two fluid drachms, sulphate of potass a scruple. Make them into a draught, for a purgative dose.

℞ Herbæ gratiolæ incisæ ℥iij.
Foliorum sennæ ℥iß.
Extracti glycyrrhizæ ℥iij.
Electuarii cassiæ ℥ij.
Aquæ distillatæ Ojß.

Leniter coque per quadrantem horæ addendo sub finem coctionis,

Myrrhæ optimæ f. ʒj.
Potassæ sulphatis ʒiß.

Cola pro usu: et sumat æger cyathum parvum pro re nata.

Take of hedge-hyssop cut into slices three ounces, senna leaves one ounce and a half, extract of liquorice three ounces, cassia electuary two ounces, distilled water a pint and a half. Gently boil them for a quarter of an hour, and towards the end of the coction add myrrh a drachm, sulphate of potass a drachm and a half. Strain for use, and let a small spoonful be taken occasionally.

℞ Potassæ supertartratis ℥ij.
Pulveris zingiberis ʒj
Syrupi ejusdem q. s.

Fiat electuarium molle, de quo capiat æger cochleare minimum ter quaterve in hora donec alvus copiose respondeat.

Take of crystals of tartar two ounces, powder of ginger one drachm, syrup of ginger sufficient to form an electuary, of which a tea spoonful is to be taken three or four times in the hour, until copious evacuations from the bowels are produced.

6. Diuretics; of colchicum, scilla, acetas potassæ, digitalis, supertartras potassæ, spiritus ætheris nitrici, cantharis, juniperis, armoracia, sinapis, genista, lactuca virosa, tabacum.

℞ Tincturæ colchici f. ʒß.
Syrupi aurantii f. ℥jß.

Fiat syrupus, cujus sumat æger cochleare minimum omni bihorio, vel subinde, donec nauseam promoveat.

Take of tincture of meadow saffron half a fluid ounce, syrup of orange peel a fluid ounce and a half. Make a syrup, of which a tea spoonful is to be taken frequently, till nausea is produced.

℞ Pilulæ scillæ gr. x.

Fiant pilulæ duæ sexta quaque hora sumendæ.

Take of squill pill ten grains. Make two pills to be taken every six hours.

℞ Pilulæ scillæ gr. vj.
Pilulæ hydrargyri gr. ijß.

Fiat pilulæ duæ nocte maneque capiendæ.

Take of squill pill six grains, blue pill two grains and a half. Make two pills to be taken night and morning.

℞ Pulveris digitalis gr. j—ij.
Hydrargyri submuriatis gr. ¼—ß.
Pilulæ scillæ gr. vj.

Fiat bolus ter in dies adhibendus.

Take of powder of foxglove from one to two grains, calomel from a quarter to half a grain, squill pill six grains. Make them into a bolus to be given three times a day.

℞ Pulveris scillæ gr. j—iij.
Pilulæ hydrargyri gr. ijß.
Extracti taraxaci gr. vj.
Olei juniperi ♏j.

Fiant pilulæ duæ ter in die sumendæ.

Take of powder of squills from one to three grains, blue pill two grains and a half, extract of dandelion six grains, oil of juniper a minim. Make two pills to be taken three times a day.

℞ Infusi armoraciæ compositi f. ʒxij.
Spiritûs juniperi compositi f. ʒij.

Fiat haustus ter in die sumendus post pilulas diureticas.

Take of compound infusion of horse-radish twelve fluid drachms, and compound spirit of juniper two fluid drachms. Make them into a draught, to be taken three times a day after the diuretic pills.

℞ Infusi armoraciæ compositi f. ʒxij.
Spiritûs ætheris nitrici f. ʒj.
Syrupi aurantii f. ʒj.

Fiat haustus ter in die sumendus.

Take of compound infusion of horse radish twelve fluid drachms, nitric spirit of ether one fluid drachm, syrup of orange peel one fluid drachm. Make them into a draught to be taken three times a day.

℞ Tincturæ scillæ ♏ xx.
Potassæ subcarbonatis gr. vj.
Misturæ camphoræ f. ℥xij.
Syrupi zingiberis f. ʒj.
Fiat haustus ter in die sumendus.

Take of tincture of squills twenty minims, subcarbonate of potass six grains, camphor mixture twelve fluid drachms, syrup of ginger one fluid drachm. Make them into a draught to be taken three times a day.

℞ Aceti scillæ f. ℥ß.
Spiritûs ætheris nitrici f. ℥iß.
Misce: capiat cochleare unum minimum ter in die ex quovis vehiculo idoneo.

Take of vinegar of squills a fluid half ounce, nitric spirit of ether a fluid ounce and a half. Mix them; let a tea spoonful be taken three times a day in any convenient vehicle.

℞ Potassæ acetatis ℈j.
Infusi quassiæ f. ℥xij.
Tincturæ digitalis ♏ x.
Fiat haustus ter in die capiendus.

Take of acetate of potass twenty grains, infusion of quassia twelve fluid drachms, tincture of foxglove ten minims. Make a draught to be taken three times a day.

℞ Potassæ subcarbonatis ℈j.
Acidi acetici ferventis q. s. ad saturationem alkali.
Misturæ camphoræ f. ℥x.
Tincturæ digitalis ♏ x.
Syrupi zingiberis f. ʒj.
Fiat haustus ter in die sumendus.

Take of subcarbonate of potass a scruple, warm vinegar sufficient to saturate the potass, camphor mixture ten fluid drachms, tincture of foxglove ten minims, syrup of ginger a fluid drachm. Make them into a draught to be taken three times a day.

℞ Potassæ supertartratis ʒj.
Potassæ sulphatis gr. x.
Pulveris rhei gr. v.
Fiat pulvis ter in die sumendus.

Take of crystals of tartar a drachm, sulphate of potass ten grains, powder of rhubarb five grains. Make them into a powder to be taken three times a day.

℞ Tincturæ cantharidis ♏ xxx.
Spiritûs ætheris nitrici f. ʒj.
Misturæ camphoræ f. ℥xij.
Syrupi zingiberis f. ʒj.
Fiat haustus ter in die sumendus.

Take of tincture of cantharides half a fluid drachm, spirit of nitric ether a fluid drachm, camphor mixture twelve fluid drachms, syrup of ginger one fluid drachm. Make a draught to be taken three times a day.

℞ Tincturæ nicotianæ ♏ x—xxx.
Infusi gentianæ compositi f. ℥vj.
Aquæ pimentæ f. ℥x.
Fiat haustus ter in die sumendus.

Take of tincture of tobacco from ten minims to half a fluid drachm, compound infusion of gentian six fluid drachms, pimento water ten fluid drachms. Make a draught to be taken three times a day.

℞ Extracti lactucæ virosæ ...
Fiant pilulæ duæ ter in die capiend...

Take of extract of strong scented let... grains. Make it into two pills to be taken ... times a day.

℞ Extracti lactucæ virosæ ℈iß.
Infusi gentianæ compositi f. ℥x.
Aquæ menthæ piperitæ f. ℥iv.
Spiritûs juniperi compositi f. ʒj.
Fiat haustus ter in die sumendus.

Take of extract of strong scented lettuce halt a drachm, compound infusion of gentian ten fluid drachms, peppermint water four fluid drachms, compound spirit of juniper one fluid drachm. Make a draught to be taken three times a day.

℞ Radicis armoraciæ excisæ ℥ij.
Seminis sinapis ℥iß.
Baccæ juniperi contusæ ℥iij.
Vini albi hispanici Oiij.
Digere per dies octo, dein cola: capiat æger cyathum parvum vinosum bis quotidie.

Take of sliced horse radish two ounces, mustard seed one ounce and a half, bruised juniper berries three ounces, white wine three pints. Digest them for eight days; then strain, and let a small wine glassful be taken twice a day.

7. Diaphoretics; compound powder of ipecacuanha; camphor; antimonials assisted by tepid diluents; the vapor bath; the copious use of aqueous diluents; water impregnated with tinctura ferri muriatis.

8. Bandages.

9. Mercury; so exhibited as just to affect the gums.

The second indication demands,

1. A light nourishing diet, with pungent aromatic vegetables; garlic, mustard, onions, cresses, Rhenish wine.

2. Tonics; cinchona, cascarilla, cusparia, quassia, preparations of steel, as recommended for dyspepsia.

3. The occasional use of diuretics and aromatics.

4. Regular exercise.

5. Cold bathing.

423. *Physcony.* Physconia.—These hard swellings of the abdomen are often exceedingly obscure in their pathology, and generally irremediable, unless attacked on their onset by mercurial medicines given to a considerable extent, so as to excite the action of the absorbents.

424. *Rickets.* Rachitis.—The irregular bony formation, the large head, flattened ribs, tumid abdomen, and general emaciation, which characterise this disorder, are not nearly so common as they were formerly; and part of the immunity is, we believe, attributable to the improvement which has recently obtained in respect of the diet and management of infants; to our having come to employ food less copiously, and fresh air more freely. This disease undoubtedly depends upon a faulty and irregular deposit of the matter which forms bone, and we should regard it but as a higher degree of mesenteric atrophy. It is a curious circumstance, with respect to rickety children, that the earthy base of which the bones are formed, is occasionally

found in the urine and other parts of the body, so that the malady is partly in consequence of there not being sufficient energy in the system to convey the earthy phosphates to their appropriate situation, and partly to the deficient formation of the matter constituting bone.

Causes.—Rickets is an hereditary disease in some families, though parents that have been affected with it have sometimes a healthy and robust offspring. 'In some instances,' says the author from whom we now extract, 'it may, I think, be traced to a venereal taint, which, though not the immediate cause, is very often an exciting one of it and scrofula. At least, it is certain that syphilis, transmitted from parents to their children, appears in the latter in a manner very different from that in which the former are affected. We find that the children of the indigent and the profligate are those most generally affected with rickets; but at the same time it must be allowed that there are many circumstances which conduce to this disease, such as damp and cold residence, impure air, inattention to cleanliness, bad nursing, want of due exercise, a deficiency of food, and debility. Difficult dentition, and the pain and bowel complaint arising from it, may favor in a powerful measure the action of the exciting cause of rickets.'

Treatment.—'The indication,' says another author, 'is by bracing the system, especially the lymphatic part of it, to promote due assimilation of the ingesta, and the consequent osseous formation.

'Purgatives of the deobstruent kind are called for, that is, those which rouse the secreting and assimilating energy. The hydrargyrus cum cretâ of the pharmacopœia is an excellent medicine; this, in combination with very small doses of powder of digitalis, should be given every night for some length of time; and the practitioner will often be surprised at the beneficial effects of this combination. It will be necessary to interpose about twice a week a calomel purge in the morning.

℞ Hydrargyri cum cretâ gr. iij.
Pulveris digitalis gr. ¼.
Fiat pulvis; omni nocte administrandus.

Take of quicksilver with chalk three grains, powder of fox-glove a quarter of a grain. Make them into a powder to be taken night and morning.

℞ Hydrargyri submuriatis gr. ij.
Pulveris jalapæ gr. iij.
Pulveris zingiberis gr. j.
Fiat pulvis; bis in septimanâ exhibendus.

Take of calomel two grains, powder of jalap three grains, of ginger one grain. Make them into a powder to be taken twice a week in the morning.

'With wholesome food, such as biscuit, good milk, arrow-root, rusks, and rice, good nursing in the open dry air being at the same time enjoined, the above medicinals will sometimes prove every thing that is wanting. When, however, by these means, the secretory and assimilating organs are got into a better state, chalybeate medicines may prove highly useful. Of these the vinum ferri, the carbonas ferri, and the tinctura ferri muriatis, are the best. The dose of the first to a young child is half a drachm; of the second two or three grains, with an equal quantity of powdered rhubarb; and of the third four or five minims.

'It is often proper to correct the acidities of the first passages, by small doses of soda, or potass, or magnesia; but the phosphates of soda and lime, which were introduced into practice some time since, are of little avail.

'The sulphate of quinine, in half grain, or grain doses, might be tried with a promise of advantage.

'Cold and sea-bathing are efficacious, should the system not be too debile for their employment.

'A small quantity (say half a glass) of good port wine will sometimes prove very serviceable to children that are rather more advanced, but who still show a rickety tendency, by the ancle and wrist bones continuing to be enlarged unduly.'

Those deformities which are met with in the Alpine valleys, deformities both of mind and body, have been considered as instances of rickets in an extreme degree. There has been, and still continues to be, a diversity of opinion respecting the actual source of cretinism, as it is called, some placing it in the water, and some in the air; some attributing it to physical, some to mental causes; and since the subject is at the same time full of interest, and as just hinted sub judice, we shall here add some remarks from two modern authors in reference to this particular modification of disorder, or this humiliating exhibition of debility and monstrosity.

'Cretinism (which is to be met with very generally among the inhabitants of that part of Switzerland nearest to Italy, in the deepest valleys of the Alps, where the atmosphere is extremely humid, in consequence of numerous waterfalls and rivulets that emit powerful exhalations through the influence of the sun's heat, while they are excluded from the access of every drying wind) is a disease which has been supposed to be only as high a degree of rachitis as human nature can possibly sustain. This opinion is corroborated by an observation that the different stages or degrees of the evil correspond with the variations in the atmosphere. Those, for example, who inhabit the deepest and most recluse valleys are reduced to the lowest state of imbecility and idiotism; in those who are somewhat more elevated the mental powers are not so completely obtunded; and others still more elevated, and of course less exposed to exhalations, will probably be deformed merely with wens or swellings about the joints, and other symptoms of rachitis. Those who are nearer to the summits are perfectly exempt from all these appearances.

Cretinism is, in many instances, connected with goitre or *bronchocele* (see this disease). An enlargement of the thyroid gland is indeed a striking feature in the unsightly aspect of the cretin, but it is not a constant attendant; for cretinism is frequently observed without any affection of the thyroid gland, and this gland is often much enlarged without any affection of the intellectual faculties.

The production of cretinism by the bad quality of the air and food, the neglect of moral edu-

cation, and other evils attendant upon poverty and indigence; and the deformity becoming so general in those regions by a seclusion from the rest of mankind, and by perpetual intermarriages, is supported by facts so strong and pointed, that the greater number of cases in mountainous districts may safely be ascribed to these causes, instead of the use of snow-water, as a few have supposed. That the use of snow-water produces either goitre or cretinism is an absurd idea; for persons born and living in places contiguous to the Glaciers, who drink no other water than what flows from the melting of snow and ice, are not afflicted with these disorders, and they are observed frequently in places where snow is unknown.

The causes of cretinism begin to operate upon the system soon after, and perhaps even before, birth; the want of energy in the parent is communicated to the offspring, the children become deformed and cachectic very early in life, the growth and development of the body are impeded, the abdomen becomes enlarged, and the glands swelled in various degrees; moreover, the powers of the mind remain dormant, and are at length obliterated, partly from the want of proper organisation, and partly from the total neglect of every thing like education.

The head of the cretin is deformed, his stature diminutive, his complexion sickly, his countenance vacant and destitute of meaning, his lips and eyelids coarse and prominent, his skin wrinkled and pendulous, his muscles loose and flabby, and frequently he is affected with an enlargement of the thyroid gland or goitre, which greatly adds to his unsightly aspect. The qualities of his mind correspond to the deranged state of his body, and the disease prevails in all the intermediate degrees from excessive stupidity to complete fatuity.

Cretinism was observed in Chinese Tartary by Sir George Staunton, in a part of that country much resembling Savoy and Switzerland in its Alpine appearance. Dr. Abercrombie mentions, that many cases of it are to be met with in the Pyrennees, and les Cevennes of France.

A race of cretins existing in the south of France has lately been presented to the notice of the profession, under the appellation of Cagotts. In this part of France this degraded race is widely extended; the individuals of it, deformed with bronchocele, have an indistinct articulation, an air of stupidity, a sallow complexion, and an extreme apathy to all external objects. The Cagotts are pretty much the same as the Cretins of the Alps; they both present the same degree of imbecility, the last remains of the intelligence of man, together with the last traces of the human form.'—*Thomas.*

'Before taking leave of Switzerland, I may be permitted to make a few remarks,' says Dr. Johnson, 'on those two blots on the physical and mental organisation of men in these interesting regions—bronchocele (goitre) and cretinism. However salutary and delightful it may be to travel among the Alps, a residence of any duration there is attended with considerable danger, at least to young people, as will be presently seen.

In respect to the goitre, or swelled neck, a great variety of opinions have been broached as to its cause. The snow-water, the air of the deep valleys, and the food of the inhabitants, have, each in turn, been accused of producing this singular deformity—a deformity, by the bye, which is far from being uncommon in some counties of England, especially in Derbyshire, Nottinghamshire, and Sussex. As to diet, it may be observed that goitre is found to be infinitely more prevalent in some parts of Switzerland than in others, though the diet is the same, or nearly so, in all. For instance, in the valley of the Rhone we see hardly any thing else than cretins and goitres; while in the valley of Chamouni, separated only by the Col de Balme from the other valley, we see very few of either diseases. This contrast must arise, therefore, from something in the air or water, or both—for the food and mode of living are the same. Moreover, we trace bronchocele along the whole course of the Rhine, from Schaffhausen to Cologne, its frequency gradually and progressively decreasing as we descend that magnificent stream. What can this be owing to? For my own part, after viewing, with no inattentive eye, the moral and physical conditions of those inhabitants of the Alpine regions where cretinism and bronchocele abound, I have come to the conclusion, that one of the main causes of bronchocele especially is to be found in the water, however much this cause may have been scouted by some medical and scientific travellers. I do not mean to say that it is the snow-water which has any thing to do with the complaint. But who can tell the thousand matters with which the Alpine waters are impregnated?—Every stream, great and small, that takes its origin from the glaciers, and other elevated crusts of ice or snow, becomes in a short time perfectly white with the particles which it wears from off every rock and mineral substance, in its noisy and precipitous route to the lakes below. Hence a bottle of water, taken from any of these streams, lets fall, on standing, a prodigious deposit of earthy and saline or mineral substances. When we consider the infinite variety of materials constituting the beds and banks of these Alpine streams, and see the quantity of detritus which they carry with them, and which is swallowed by the inhabitants, we can have very little doubt that such ingredients have no trifling influence on the physical organisation of man. This supposition is strengthened by the fact which I have just mentioned, that bronchocele gradually and progressively decreases, as we descend the Rhine—a river that rises in the Alps, and is chiefly supplied by Alpine waters. It is hardly necessary to observe that, as the river increases its distance from the Alps, it lets fall the matters with which it was impregnated, as well as becomes mixed with auxiliary streams from countries not Alpine. This change is remarkable also in the Rhone. The Upper Rhone, where it falls into the lake of Geneva, is turbid even to whiteness; but its waters, while nearly quiescent in the lake, become clear, and pass through the city of Geneva like translucent streams of bluish crystal. Among those who inhabit the banks and drink the waters of the upper or turbid Rhone (namely, in the Valais)

there are twenty cretins and goitres for one that can be seen on the lower or filtered Rhone, in its progress to the Mediterranean. Although I do not contend that all this difference is owing to the change in the waters, yet, taken in connexion with the Rhine, I think it forms a strong ground of presumption in favor of the goitrefactive (if I may use such expression), influence of Alpine waters. That the cause of bronchocele cannot be traced to sour bread, or indeed to any particular article of diet (the water excepted), at least in Switzerland, is proved by the fact, that English children (who live as well as people in England) cannot be kept long at Geneva, or in any other part of Switzerland, without having enlargements of the thyroid gland. This fact is well known to those English families who sojourn in that romantic country.

But, it may be asked, can the waters in Derbyshire, or other goitrous counties in England, be the cause of bronchocele? I may answer that it is much more probable that the cause of the disease should reside in the earth than in the air—and, if in the former, surely the water which we drink is the most likely vehicle for its conveyance into the constitution. There is a mineral or saline substance in nature which is capable of removing this swelling of the thyroid gland—for instance, iodine;—and why should there not be another saline or mineral substance which is capable of producing the said swelling?—The same valley which issues forth the miasma that causes ague, gives birth to the tree that furnishes the quinine, which cures the disease.

When on this subject I may remark that, from an attentive survey of the Alpine valleys, it appeared to me that cretinism and bronchocele were only two prominent features of one great physical and intellectual deterioration which pervades the inhabitants of scenes the most romantic, sublime, and beautiful, that human eye has ever yet beheld. It is not the swelled neck, the enormous head, and the vacuity of mind alone that arrest our attention in traversing the Alpine regions. The whole corporeal fabric, with all its intellectual prerogatives, is stunted, deformed,—and, as it were, absorbed. Well might Goldsmith say—

Man is the only plant that dwindles here.

Every feature and phenomenon of nature around is wild, grand, and impressive—while he who is master of the whole, and the alleged image of his Creator, is an abomination to the sight.'

422. Order 3. Impetiginous Disorders.—On this head we shall be exceedingly brief, since the ailments which are included under it are for the most part those which deform the skin, or appear as cutaneous affections, a subject which we shall consider, with one or two others, in the way of appendix to the nosology.

Scrofula, syphilis, scurvy, elephantiasis, leprosy, yaws plaited hair, and jaundice, are the genera of this order, and it is only upon the first, third, and two last genera that we are now called upon to descant. Syphilis being referred to Surgery, and the remaining genera to the general head of *cutaneous disorder*.

423 *Scrofula*.—Of scrofula we have already spoken in the introduction to the present class. Indeed it is the foundation as it were, and susceptibility to disordered action, rather than itself a disease—thus the varied modifications of disorder to which we have already alluded, as having in their manifestation considerable connexion with the states of the lymphatic system, are in truth so many indices of scrofulous temperament, and they have been made to come out into actual disease, by exciting causes happening to fall upon the scrofulous or lymphatic diathesis.

Causes.—The taint or the disposition, or that conformation of body which leads to lymphatic and glandular derangement, is evidently hereditary, as what disposition or tendencyis not? The dispute indeed respecting hereditary disorders seems idle in the extreme—no one will or can deny that the son and daughter bring with them into the world physical and moral dispositions, inherited from their parents, and the disposition readily to break out into any particular form of disorder is all, we should suppose, that any one would contend for. The exciting causes of scrofulous diseases are the excitants of disease generally, but cold and variable and humid climates are the hotbeds, if it is not a contradiction so to say, of scrofula. The disorder is excited both by pampering and starving, both by too rich and too poor a diet.

Treatment.—The treatment of suppurating lymphatic glands, which are the most common manifestations of scrofula, will be considered in the article Surgery. In respect to the medical counteractives of scrofula generally, they are all resolvable into the administration of those articles which impart tone and vigor to the system generally, and act peculiarly upon the lymphatic part of the organisation. It is usual for parents to send their scrofulous children down to the sea-side, but there does not seem any specific virtue connected with a residence on the sea-coast; and it can only be considered useful in scrofula, inasmuch as any thing is likely to be serviceable that braces and strengthens the frame. Steel and bark are used with this intention; the sulphate of quinine in small doses may occasionally prove very advantageous. For the remaining few remarks which we have to make, on the subject of remedies for scrofula, we shall again draw upon the Compendium of Medicine.

The ammoniated iron, or the carbonate of the same metal, three or four grains of the former, or four or five of the latter, may be given to a child four or five years old, with a grain or two of rhubarb added to each dose.

Respecting the specific virtues of muriate of barytes and lime, about which there was much talk some few years since, I am sceptical; their efficacy, if they have any, is resolvable into tonic agency, and corrective operation upon the first passages.

When, in after life, scrofulous appearances are complicated with syphilitic taints, the decoctum sarsaparillæ compositum may, perhaps, be administered with advantage; administering at the same time five grains of the pilula hydrargyri submuriatis compositæ, every night.

Soda may be employed, together with the

conium and hyoscyamus, in the management of scrofulous disorders, that consist at once of derangements in the stomach and bowels, and local affections.

> ℞ Sodæ subcarbonatis exsiccatæ ʒj.
> Extracti hyoscyami,
> Extracti conii, āā ʒß.
> Pulveris rhéi gr. xv.
> Mucilaginis acaciæ q. s.
> Fiant pilulæ xxx.; sumat ij. ter in die.

Take of dried subcarbonate of soda one drachm, extract of henbane and hemlock of each half a drachm, powder of rhubarb fifteen grains, mucilage enough to make thirty pills; two to be taken three times a day.

From ten grains to a scruple of the spongia usta are given in cases of glandular affections, made into a powder with sugar; and iodine in different forms has recently been much lauded, especially in that enlargement of the thyroid gland which constitutes bronchocele; and which, perhaps, principally depends upon the same cause as the disorder of the lymphatic glands. See *Dr. Gairdner's pamphlet on Iodine in Bronchocele, Scrofula*, &c.

424. *Scurvy*. Scorbutus.—This is one of those diseases which demonstrate in a marked manner the influence which the depressing passions possess, not only upon the nervous organization, but upon the blood-vessels and general frame; for its great remedies, as it has been expressed by a writer whom we have often quoted in the present article, are 'change from despondency to hope, from filth to cleanliness, and from cold and damp to a temperate and dry climate.'

The disease, however, in its true and legitimate character, seldom appears but at sea, and is manifestly dependent in a great measure upon a long course of salted, dry, and putrid provisions; its symptoms, when occurring in this full extent, are, besides those put down in the definition, spongy bleeding gums, great depression of the animal powers, fœtid excretions, and occasionally spontaneous hæmorrhages from the bowels, the nose, and even from the ears and finger extremities.

Causes.—To these we have just referred; in respect to its proximate cause we should say, that it mainly consists in a disordered state of the blood, which breaks down its crasis and renders it unfit for the supply of the several secretory and excretory organs; hence the emaciation and debility, hence the hæmorrhagic disposition, the fœtid breath, the offensive evacuations, and all the general symptoms which connect themselves with this disease. At the time when the chemical changes which take place in the blood, in the process of respiration, were the topics of particular interest, there was much crude theory proposed in the way of explaining disorders upon degrees of oxygenation and deoxygenation; and although, as we have said, some of these theories were vague and much wanting in the precision and completeness which should always attend the admission of premises and the deduction of inference, yet the speculations themselves were of service had they done nothing else but call attention to the chemical habits and conditions of the blood in reference to the atmosphere.

'Various theories have indeed been advanced with respect to scurvy. By Sir John Pringle it has been supposed to be owing to a putrescency of the blood. By Dr. Lind, Dr. Blane, and Dr. Millman, it has been looked upon as a disease of debility, having its origin in the weakness of the organs of digestion, or in the gradual diminution of the vital power by the remote causes; or that it is owing rather to a defect of nourishment than to a vitiated state of it. Dr. Trotter, reasoning from the experiments of Dr. Goodwin concerning the action of dephlogisticated air on the blood, infers that the black color of this in scurvy is owing to the abstraction of this principle (dephlogisticated air), and that fresh vegetables cure the disease by restoring to the blood this lost principle. Dr. Beddoes supposes scurvy to be owing to a gradual abstraction of oxygen from the whole system, just as death is produced in drowning, by withholding all at once the same substance from that blood which is to pass the posterior cavities of the heart. Of the two causes of scurvy, want of fresh vegetables, or want of air sufficiently furnished with oxygen, Dr. Beddoes thinks the latter is by far the most powerful. Captain Cook's unexampled success in preserving his crews from the scurvy, during his last two voyages, seems to have been owing in a great measure to his extreme care in keeping every part of the ship well ventilated. The crew on many occasions were reduced to salt provisions, and much longer out of sight of the land than many other ships which have been dreadfully afflicted with the scurvy. In his last voyage there did not appear among the men any symptoms of this disorder; and, in his second, only one man had it in any considerable degree.'

Diagnosis.—The fœtid exhalations, spongy gums, and depressed spirits of the patient laboring under scurvy distinguish it from other diseases; the purpura hæmorrhagica or petechiæ sine febre is perhaps more allied to scorbutus than any other affection, but it is without the above manifestation. When petechiæ occur in malignant fever, the prior pyrexia sufficiently marks the distinction.

Prognosis.—Should the exciting causes continue to act with much force, the prognosis is unfavorable; but it is remarkable how speedily the disorder, even at its height, will yield to change of circumstances, of air, and of diet.

Treatment.—Vegetable food and vegetable acids are the principal antiscorbutics; nitre is also a good medicine in scurvy; this, given in conjunction with Peruvian bark, will often be found very useful. Our author has proposed that ships should be provided with the concentrated preparation of bark, the sulphate of quinine. The mineral acids also as well as the vegetable are good antiscorbutics; but the great principle of preventive treatment is that of procuring a good supply of fresh animal and vegetable food; and preserving ships' crews from the habits which under all circumstances tend to engender disease, but under circumstances of deprivation greatly increase such tendency. On this head we shall take the liberty of again extracting some paragraphs from the comprehensive and useful work of Dr. Thomas.

In all long voyages it ought to be our object not only to find out and employ the most effectual means to cure the scurvy when it shows itself, but likewise to prevent its arising at all, as the taint never fails to give a fatal or malignant tendency to the other disorders incident to seamen, such as ulcers, dysentery, &c.; and, with this view, our preventive plan ought to commence from the first day on which the sailing stock of fresh vegetables and ship's beer is expended; since from many experiments it appears that much greater success is likely to attend our endeavours in this way, than by reserving them for the period in which the marks of a scorbutic diathesis begin to manifest themselves.

When, from a want of the proper precautions before pointed out, the scurvy makes its appearance among a number of men, be it on board of a ship or in a close garrison, we are then to counteract its effects, first by obviating the putrid state of the system, and secondly by restoring it to its former vigor.

The first of these is to be accomplished by a diet of fresh animal and vegetable food, but more particularly the latter, consisting of garden and water cress, mustard, horse-radish, common radish, scurvy-grass, celery, endive, and lettuces, all of which may be eaten in their crude state, together with spinach, beet, carrots, turnips, cabbages, cauliflowers, brocoli, asparagus, the young shoots of hops, &c., which may be prepared by any common process of cookery. To these may be added a free use of ripe fruits, especially those of a subacid kind, such as oranges, shadocks, and others of this class. For ordinary drink the patient may use milk, or its productions, as whey, butter-milk, &c., or else an infusion of malt or spruce.

Such things are, however, only to be procured on shore, and therefore cannot be obtained for a ship's crew, unless they remain in port. When at sea, other substitutes must be resorted to.

One of the most effectual of this kind has been found to be lemon-juice, with which most ships belonging to government, and bound on a long voyage, are, I understand, now supplied; and I am informed that the daily regulated allowance is now one fluid ounce, mixed with one ounce and a half of sugar. Where fresh vegetables are not to be obtained, we ought to have recourse to this. To render its effects more certain, and prevent it from irritating the bowels, we should mix it with a sufficient quantity of water and sugar, which will make a pleasant drink, usually known under the name of sherbet. If a due proportion of wine is added, it will render it still more antiseptic. The quantity of juice used, during the first three or four days, ought not to exceed two ounces daily, but it may afterwards be increased to three or four per diem.

In Dr. Trotter's Medicina Nautica is inserted a letter from Mr. A. Baird, surgeon to the Hector ship of war, communicating to him the wonderful benefit derived from the use of lemon-juice in a voyage to and from the East Indies, during which, although the scurvy became very prevalent, he did not lose a single man. His words are, 'When I consider the alarming progress which the scurvy was making among the Hector ship's company previous to the administration of lemon-juice as a preventive, the sudden check that disease met with afterwards, and the powerful effect of the acid in very bad cases, I think I shall not be accused of presumption when I pronounce it, if properly administered, a most infallible remedy both in the cure and prevention of scurvy.'

Where the fresh juice cannot be procured we may substitute, with the greatest advantage, the citric acid in a concrete form, as first prepared by Mr. Coxwell. We are informed by Dr. Trotter that he has experienced its powers against scurvy to be equal to any effect he has ever observed from the recent fruit in its most perfect state. Other practitioners have reported alike favorably of it. It takes from sixteen to eighteen parts of water to bring the concrete acid to the standard of lemon-juce. It is obtained after the manner of Scheele, by combining the fresh vegetable acid with lime, and then precipitating by means of the sulphuric acid. See Pharmacy.

Dr. Trotter observes, that government mistake in making their contract for lemon-juice for the use of the navy, as what is furnished is often adulterated with the acetous acid, and sometimes contains the pulp, which render it liable to ferment. Lemon, and lime-juice,' he says, 'should be procured in Portugal and the West Indies, and in each place be combined with calcareous earth. It may be imported in barrels, and in that state be sent to sea, when the separation of the liquid acid is so easy a process as to require no trouble, and the medicine will be always in the best state. Combined with calcareous earth, the acid will remain unchanged for a great length of time.

It has been common to employ the fossil acids in this disease; but there is some reason to doubt if they are of any service, and it is certain they are not effectual remedies. Moreover, they can hardly be thrown in in such a quantity as to be useful antiseptics.

In a Treatise on Scurvy, by Mr. D. Patterson, surgeon in the navy, we are informed, that, from certain reasons, he was induced to try a solution of the nitrate of potass in common vinegar in several cases of this disease, which, with inexpressible pleasure, he saw to succeed in every one of them; and from frequent trials of it he is convinced that the scurvy may be cured at sea without the assistance of recent vegetable matter. If this turns out as stated, the discovery will indeed prove of great national advantage.

Mr. Patterson supposes that the good effects of the nitrate of potass, in mitigating or removing the disease, are to be accounted for solely from the dephlogisticated or vital air it contains, and that it may be rendered more active by being combined with an acid. He allows common vinegar to be of little or no utility when given by itself; yet supposes, that, if it were charged with dephlogisticated or oxygen air, it might prove highly beneficial; and this he presumes to be effected by the addition of nitre. The following is his method of preparing this new remedy, and making use of it.

At first he dissolved two ounces of nitre in one

quart of the ship's vinegar, and gave half an ounce of the solution (which he named acidum nitrosum, or nitric vinegar) to some twice, to others thrice, in the day, and as frequently bathed their blotched and ulcerated limbs with the same. From the good effect it had, and from its not producing the smallest degree of nausea, colic, or diarrhœa, he was induced to augument the dose to an ounce, and to repeat it as often as before.

Finding by far the greater number of scorbutics who were under his charge bore the increased dose of the medicine without expressing the least uneasiness, he now, instead of two, dissolved four ounces of nitre in one quart of vinegar, and gave from half an ounce to two ounces of this strong solution twice, thrice, or four times in the day, if they were either blotched, stiff, or ulcerated. In this manner, we are informed, he continues to use it.

He adds, 'Some patients cannot bear the nitric vinegar without the addition of water; while others, without the least inconveniency, bear it undiluted. The discharge by stool, or the presence of gripes and nausea, guide me with respect to increasing or diminishing the dose of the nitric vinegar; but at the same time it is not a slight degree either of nausea, colica, or diarrhœa, that renders an alteration in the quantity of the medicine necessary. To a great number of scorbutic patients eight ounces of this strong solution, containing one ounce of nitre, have in the course of the day, as long as such a quantity was necessary, been administered to each with the greatest success. Also, a circumstance no less curious than pleasing, large and frequently-repeated doses of this medicine have been given in cases of dysenteria scorbutica; and instead of increasing I have always found it remove the disease. Sometimes, notwithstanding the free use of the nitric vinegar, I have known constipation take place to a considerable degree; in which case I have found intermediate doses of the potassæ supertartras necessary and highly advantageous. This very constipated state generally occurred where the disease was far advanced; but in a few particular cases in delicate habits, and where the disease was not far advanced, I perceived even small doses of the nitric vinegar ruffle the stomach and intestines; to prevent or remove which I have found two, three, or four grains of camphor, with each dose of the medicine, very effectual.'

The effects of this medicine are as follow:— 'During a course of the nitric vinegar the belly in general is kept gently lax; the discharge of urine is increased, and changes from an alkaline to a healthy nature; the skin becomes open and more agreeable to the touch; the chilness is changed to a pleasing warmth; and the pulse acquires steadiness and healthy strength. Sleep comes to be more and more natural. The sallow and the gloomy is gradually changed into a clear and cheerful countenance. By degrees the inflammation of the mouth and nose subsides; the gums heal and get firm. The lower extremities lose, faster than could have been supposed, their livid hue; they gradually become softer, less painful, and more flexible, and ulcers put on a healthy appearance and skin over. The great oppression about the breast and stomach gives way, and the cough and the breathing become less laborious. The appetite and the sense of taste are restored; the depression of spirits and the lassitude are not remembered; the strength increases, and at last health returns.'

Mr. Patterson, in comparing the effect of vegetable acid with that of the nitric vinegar, writes as follows:—'In the month of July, 1794, at sea, a small quantity of limes were purchased by order of admiral Murray, for the use of the scorbutics at that time on board; but, instead of depending altogether on their power, I gave them only to a certain number, on purpose to compare their effect with that of the nitric vinegar, which was more generally administered; and from what I have seen of both, and after having weighed all circumstances, I am at present inclined to decide in favor of the latter.'

Such is the report made by Mr. Patterson on the effect of these two acids; and as he seems to attribute the good effect of the remedy which he most approves of to the nitre it contains, and not to the vinegar, I beg leave, continues Dr. Thomas, to propose the following query:—Might not a solution of the nitrate of potass in lemon or lime-juice, which of themselves are powerful remedies in scurvy, be preferable to a solution of it in vinegar, or even to these acids given by themselves?

By the means which have been pointed out, together with some other auxiliaries, such as spruce-beer, fresh infusions of malt or wort, sugar, and the succus cochleariæ compositus, we are induced to suppose that we shall in most cases, even in those of a desperate nature, be able to obviate the putrid tendency of the system, and effect a cure. Introducing oxygen into the system by any kind of means may likewise prove a good auxiliary.

It appears that the gases were used by the celebrated navigator La Pérouse in his voyage round the world; but he very wisely observes, that bottles-full of them might be swallowed without doing seamen a thousandth part of the good they receive from good slices of roast beef, turtle, fish, fruit, herbs, &c.

425. *Plaited hair.* — Plica polonica or trichoma.—In some parts of the north of Europe, especially in Poland, this disease is endemic; it is a disease in which a matter issuing from the head is deposited upon the hair, and so binds or plaits it together, that it is impossible to unravel it. It would appear to be a malignant degree of the porrigo of authors.

Causes.—There is said to be some obscurity respecting the exciting cause of this affection, inasmuch as cleanliness and regular combing of the hair do not afford securities against its visits. It should however be observed, that, in the countries where this disorder is endemic, it spreads only among the lower classes of people, whose diet is poor and irregular, and whose habits are such as to encourage the spread of a contagious affection. It is said to be hereditary, or that a disposition to it is transmitted from parent to offspring; and what disposition, as we have just before enquired, is not so transmitted? It is, however, a curious fact, that strangers are not so

liable to the disease as the natives, although they may fall into the same habits of uncleanliness or neglect; thus it should seem that the endemial disposition requires some length of residence to become established. It is further stated, that, in the countries obnoxious to the malady, some of the lower animals become subiect to a distemper of a similar nature; so that upon the whole it should seem that the predisposition to be affected by the common excitants of the complaint has some connexion with the peculiarities of soil or air of the place.

Cure.—'Cleanliness is its great preventive and cure; the hair should be taken off; the head kept well washed with soap and water, and very small doses of mercury may be occasionally necessary to correct the disordered habit. Indeed, one general principle pervades the requisites in these cutaneous ailments; and, with little exception, what is serviceable to one is serviceable to all. Drugs without cleanliness would make a sorry figure in all cases.'

It seems that an opinion is generally entertained among the Polanders, that there is danger in cutting off the hair, and that promoting the cure by external remedies is totally erroneous. The following fact which is quoted by Dr. Thomas proves the error and absurdity of this notion.

Some years ago, one-third of the recruits of the regiments of artillery brought from South Prussia were attacked with plica polonica. An order was received from Berlin to send to that city all those that were infected, and to take care that the disease was not communicated to others. This order, it appears, was not agreeable to the commanders of companies, as it would have occasioned the loss of at least 200 young soldiers. M. Hœnel, sugeon-major to the artillery regiment, became mediator in the cause; he made the recruits be brought on the ramparts, and ordered that a general shaving should be made. In a little time, a pile of plica was accumulated; these trophies were then cast into a ditch, and the heads of the men carefully washed with soap and water daily for some weeks; by this simple method those dirty Polanders were speedily transformed into good soldiers, without having in the least suffered by the loss of this precious ornament of their heads.

426. *Jaundice.* Icterus.—Jaundice is characterised by a yellowness of the skin, and of the whites of the eyes; by fæces of a whitish color and clayey consistence; by urine of a yellowish or rather obscure red color, tinging with a yellow hue linen that is dipped in it; by lassitude and indisposition to exertion; and by a lowness of spirits. All these symptoms being easily referrible to that quantity of bile being in the liver and general system which ought naturally to flow through the intestines, but which is prevented from thus supplying the intestines by several sorts of impediments.

Hepatic inflammation continuing for a time unsubdued, the coats of the bile-ducts will thereby become thickened, their diameter in consequence materially diminished, and thus a species of jaundice produced of a permanent and incurable nature. That yellowness of the skin and general depression of the spirits which we sometimes observe as the result of a long continued course of indulgence in the free use of spirituous liquors may often be brought about at least partly upon this principle; but partly perhaps by the schirrous enlargement of a liver which has been subjected to repeated inflammations pressing upon and thus lessening the diameter of the bile-ducts, which state of the liver, besides producing a tardy secretion, thus occasions a tardy flow of the bile that is secreted, and it has hence time by congestion in the liver to get into the blood vessels by re-absorption or by reflux. When then we are called upon to treat jaundice, it is scarcely necessary to say how highly important it must be to learn with as much exactitude as may be the actual state, not merely of the passages through which the bile flows, but the condition itself of the organ by which the bile is secreted; that our indications of cure may be built upon some rational grounds, and that we may be able to foretel, with any thing like certainty, the continuance and event of the malady upon which we have to exercise our discernment.

The above kinds of jaundice are more or less of an incurable nature: of this disorder there are, however, some species in which the interference of art is signally and abundantly beneficial. Gall-stones or inspissations of the bile plugging up the duct, and thus preventing the passages of the fluid, and spasms on these ducts, are the sources of jaundice which are principally treated of as those which the practitioner of medicine will be called upon occasionally to detect and to obviate; but there is another species of the malady which has been properly enough called icterus mucosus, which is neither attended by pain as in gall-stones, nor by spasmodic affections, in which no gall-stones are observed in the fæces, but in which by cathartics a large quantity of viscid mucus will be discharged. Van Swieten talks of colluvies pituitosa in primis viis as often the cause of jaundice, and it most certainly is so without either gall-stone obstruction, or spasmodic attacks about the ducts. When with persons of sedentary habits and hypochondriacal temperament, the skin assumes a decidedly icteric hue, the urine becomes unusually high colored, the fæces lose their proper excrementitious character, and the mind is much depressed, we may refer the impeded flow of bile which is attendant upon this state of things, partly to a direct and immediate deficiency of action, and partly to an accumulation of viscidities about the mouth of the bile-ducts, preventing the due intestinal supply. This effect, says a modern writer, may be more readily conceived if we call to mind the very oblique direction in which the duct penetrates the coats of the intestine, and that it passes for a short space between two of them. When thus the mouth of the common duct is closed, we have commonly not only obstruction to the passage of the bile into the intestine, but of the pancreatic secretion, because most frequently the pancreatic duct enters the duodenum by the same orifice, and then, for want of these stimulant and detergent fluids, tenacious slime accumulates, and the disease goes on still increasing.

The next species of curable jaundice which we

shall notice is that occasioned by those concretions which are called gall-stones; and, when these are the cause of the symptoms, the progress and establishment of the disorder is very considerably different. In this case there is often violent and protracted pain in some part about the region of the liver, or rather in the upper part of the abdomen, following the course of the ducts. This pain often comes on suddenly and continues for some time before any appearance of jaundice denotes the true nature of the malady; and it is highly proper for the young practitioner especially to take due cognizance of this pain, inasmuch as from its violence it may be supposed to be an inflammation of the bowels, and decided upon as such when subsequent appearances shall prove the fallacy of the prescriber's opinion. Let then the following marks of distinction be duly observed between the pain arising from the passage of gall-stones, or from spasms about the gall-ducts, and that dependent upon an inflammation of the bowels. In the first place this gall-duct pain is for the most part rather higher in its situation than enteritic pain; it comes upon the patient suddenly without any preliminary marks of incipient inflammation, such as shiverings or rigors; and lastly, as the principal point of difference, let it be recollected that the pulse is never accelerated as in the same degree of pain of an inflammatory nature. It is very seldom indeed that the number of pulsations rises to more than 100 in a minute; they are for the most part much under, while, with the same measure of pain dependent upon actual inflammation, the pulse would invariably be running to 120 or 130. The pain too remits, especially if the obstruction be merely spasmodic, and even occasionally when there are gall-stones; but there is not this remission in inflammatory pain; and further the patient has an instinctive inclination to bend the body forward in order to obtain relief, which is also sometimes obtained by pressure upon the part contrary to what is observed in enteritis. But the difference with regard to the number of pulsations forms the surest criterion of distinction: and it has been well observed, by a writer on this subject, that the more exquisite the pain is, provided the pulse is below 100 in a minute, with the more confidence may we rely upon this diagnostic symptom; inasmuch as such pain could only arise from the inflammation of a membrane, in which case the pulse would far exceed the number above specified. Before we make any observations on the nature and composition of biliary calculi, we shall say a word or two further on the spasmodic jaundice of authors; this is sometimes unaccompanied by pain, and at other times attended by a pain almost as acute as in the instance of gall-stones passing through the ducts; it generally attacks individuals of a sanguine and irritable temperament, and is either produced by violent passions of the mind, or by sympathetic irritations, such as worms, or indigestible matter in the bowels: it is often exceedingly transient. Its existence has been confirmed by anatomical observations, since some dissections that have been made of persons dying with this species of jaundice upon them, have proved the non-existence of either calculi or any cause of mechanical obstruction. As, however, the ducts themselves are composed entirely of membrane, and are not muscular, they cannot well be conceived susceptible of spasmodic action; and when the obstruction is from this source the spasm must be supposed to take place at the part of the duodenum itself in which the duct enters in the oblique manner already described, and thus the spasmodic action of the intestine constitutes the obstructing cause.

Dr. Darwin attributes one species of jaundice to an inirritability as he calls it of the gall-bladder. The jaundice of aged people, and which attends some fevers, is believed to be caused very frequently by a palsied state of the gall-bladder.

Darwin, indeed, mentions the case of a gentleman between forty and fifty years of age, who had labored under the jaundice about six weeks, without pain, sickness, or fever, and had taken emetics, cathartics, mercurials, bitters, chalybeates, ether, &c., without any apparent advantage. On a supposition that the obstruction of the bile might be owing to a paralysis or torpid action of the common bile-duct, and the stimulants taken into the stomach seeming to have no effect, he directed half a score of smart electric shocks, from a coated bottle which held about a quart, to be passed through the liver, and along the course of the common gall-duct as near as could be guessed, and on that very day the stools became yellow; the electric shock being continued a few days more the patient's skin became gradually clear. Such cases as these ought to be had in recollection, since the multiplication of our resources when the common ones fail is always desirable, and, when we successfully have recourse to expedients that are a little out of the common way, the impression upon others is at once more favorable, and the satisfaction of our minds greater.

But, to revert to the subject of gall-stones we may observe in the first place upon the difficulty there is in conceiving the principle upon which these bodies are impelled through the duct, since there is no muscular power of propulsion, and since, even if there were, the propelling power would, as it has justly been observed, be as likely to push the body in one direction as in another; and all those medicines which are given for the purpose of irritating the duct into stronger contractions would be as likely to do good as harm. It would appear that the effect is produced by the pressure of the fluid bile from behind, and that thus the very size of the calculus serves at times to facilitate its own expulsion, since this à posteriori pressure is more likely to be effectual, provided the stony concretion so occupies the whole canal as not to permit the passage of any fluid bile between it and the inner sides of the intestine. Dr. Pemberton observes 'that this idea of the passage of a gall-stone may perhaps serve in some measure to explain the uncertainty in the power of emetics in forwarding a gall-stone. We all know that the effect of an emetic is not only to produce relaxation of the whole body, but also to increase the secretion of bile; this increased secretion of bile, if its exit be prevented,

will mechanically increase the distension of the duct, and thus will a passage be opened for the calculus. If this position be true, it will follow that an emetic cannot assist the expulsion unless there is a total stoppage of the duct; for, without this, the bile would pass off, and no distension take place. The frequent failure of emetics, in making any impression upon the disease, sufficiently argues a modification of the complaint over which they have no power. This state I take to be that in which the stone, in consequence of its angles, does not completely close the duct.' It is astonishing to what size gall-stones will sometimes pass through the duct without occasioning mechanical injury. 'I have in my possession,' says the author from whom we have made the above extract, 'the model of one, whose long diameter is two inches and a quarter, and whose short diameter is one inch and a quarter.' He conceives that in this case ulceration had taken place between the duct and the duodenum, and that thus an aperture was made for the stone to pass into the intestines. Of this, however, there does not seem to be any positive proof. But although it does not seem by any means certain that the gall-stone just mentioned made its way by exciting inflammation and ultimately ulceration, it is a fact that such events do sometimes follow upon the attempt at a passage of very large concretions. 'An interesting case,' says a modern author, 'of inflammation of the gall-bladder proceeding from biliary calculi, and terminating in suppuration, which at length pointed externally, came under my observation some years back. The patient was a woman of about forty years of age, who for a considerable time had been severely afflicted with pain in the stomach, febrile heat, faintings, and a purging. After a month or so there arose a swelling near the navel, which upon being opened discharged a quantity of yellow matter for many days. The pain becoming very acute in the tumor, the surgeon was induced to introduce his probe into the orifice of the wound, when to his astonishment he found a hard gritty substance at the bottom of it, which upon being discharged a few days afterwards proved to be a gall-stone of the size of a common nut. This was shortly succeeded by another, and in due time the woman's health was perfectly restored.'—*Thomas.*

Biliary calculi are supposed to be principally formed in the gall-bladder, for here the bile is more stationary and viscid; and, although the modus operandi of their production is obscure, it seems to be from irregularity in secretion and absorption. They consist, we are told by chemists, principally of that peculiar substance which Fourcroy calls adipocire. 'They are divisible,' says Dr. Thomson, 'into four classes. The first kind comprehends those which have a white color, and a crystallised, shining, lamellated structure. They consist of adipocire. The second species are polygonal of a light grayish-brown color. Externally they have a covering composed of thin concentric layers, within, a matter either crystallised or having the appearance of coagulated honey. They are also composed chiefly of adipocire, but contain a small portion of brown matter, consisting as it appears of inspissated bile. The third are of a brown color, and are supposed to be more decidedly formed of inspissated bile. (This kind of gall-stones is principally found in the inferior animals.) The fourth species comprehends those gall-stones which do not flame but gradually waste away at a red heat. The two first kind, or those constituted principally of adipocire, are those which are oftenest found in the human subject.' 'There is,' says Dr. Monro, 'a fifth but very rare kind of biliary calculi, which, as far as I know, has not been described, which is of a jet black color, of a shining appearance, and seldom attains a large size, and is very irregular on the surface. I have never seen such calculi but in the ductus communis choledicus.'

With regard to the *prognosis* and *treatment* of jaundice every thing of course must depend upon the nature of the obstruction which produces the complaint. Should there be reason to suspect schirrosities, as the result of gradual chronic inflammations of the liver, the malady is to be viewed as in a great measure hopeless, and the subject for the most part stands upon the brink of an abdominal dropsy by which he will sooner or later be carried off. That species, too, which depends upon the thickening of the villous coat of the gall-ducts, does not for the most part admit of much remedy; but in this case the jaundice is not always of so complete or so hopeless a nature; since, though the thickness of the ducts may remain, and thus impede the due supply of bile to the intestine, the obstruction is in no part of the ducts complete; and, with regularity of diet and habits, the liver may eventually come to accommodate itself as to the quantity it secretes to the quantity that can pass off.

It is in the three remaining sources of jaundice that we have a prospect of accomplishing much by medicine, and which when uncomplicated with any other affection are for the most part diseases of no very long continuance. When we imagine the obstructing cause to consist in duodenal viscidities or mucous obstructions merely at the entrance of the duct into the intestines, we must set about the administration of such medicinals as are calculated at once to purge off these viscidities, and restore the secretory power of the duct and intestines to their wonted tone. Emetics are often very useful in this species of jaundice, and they in some measure answer both the purposes of emulging and exciting new actions. The combination of purgatives with bitters, as mentioned under the head of *Stomach Affections*, will prove very useful in icterus mucosus. Should there be reason to suppose much hepatic torpor, the exhibition of calomel over night to be succeeded in the morning by a purgative will answer a very good purpose; this plan may be pursued once or twice a week, and some tonic bitter, such as quassia or gentian, be taken twice or three times a day during the time. This kind of jaundice is most usually brought on by sedentary habits, and mental depressions; regular exercise therefore, with the excitation as much as may be of pleasurable feeling, it is scarcely necessary to observe, are always desirable. This kind of jaundice may be distinguished from liver affection by the absence of those symptoms which

denote schirrous obstructions in this organ; it may be distinguished from the jaundice of spasm and gall-stones by the slowness of its approach, and by the subject of it being exempt from pain, at least when there is pain it has nothing in it of that acute and violent kind which gall-stones and spasm produce.

When the obstruction of the ducts is from gall-stones, and when these occasion that extreme pain of which we have above spoken, warm fomentation, or the warm bath, and opium, are the principal resources of the practitioner. The quantity of opium (says a modern writer) ought to have no limit but the abatement of the pain, and, till that object be effected, the patient should take a grain of solid opium, or twenty-five drops of tincture of opium every hour.' Enemas, too, composed of starch and about a drachm of tincture of opium, will frequently assist much in mitigating the sufferings of the patient; which it should seem is the principal thing that it is in our power to do, since, from what we have above observed, it is at least problematical whether an immediate and actual aid is given to the propulsion of the obstructing body by any medicinals which we employ. An emetic may indeed, as above hinted, assist its passage mechanically by occasioning a large secretion of bile; but we are for the most part disinclined to their employment, since the irritation excited by the pain is already so great as to induce a wariness in the use of any measures which are calculated to augment this systematic disturbance.

In the general way we should regard emetics as more precisely applicable to the icterus mucosus, than useful in facilitating the passage of gall-stones. There is a curious case related at length in Hoffman of an obstinate jaundice being cured entirely by emetics. This Hoffman treated as an instance of jaundice arising, as he expresses it, 'à bile copiosori, viscida, et in ductibus biliosis non minus ac intestino duodeno stagnante.' The subject of this attack took a scruple of ipecacuanha, and one of tartar emetic, which after the lapse of five days was repeated, and thus the cure accomplished.

With regard to the specific solvent power of any materials, inferred from the same effect being produced out of the body, the exercise of such solvent property when they are received by the stomach is, to say the very least, abundantly doubtful. Ether for instance, and spirits of turpentine, as well as the pure alkalis, and nitric acid, are all capable of dissolving the most usually found biliary concretions, and these have, therefore, in various forms been suggested as internal medicines in cases of biliary obstructions. Ether with yolk of egg is recommended, says Darwin, as having a tendency to dissolve inspissated bile. And a decoction of madder is recommended for the same purpose, because the bile of animals, whose food was mixed with madder, was found always in a dilute state. The same author speaks with others of the beneficial effects of raw cabbage, and other acrid vegetables, as water cresses and mustard. It is said that horses are subject to inspissated bile with yellow eyes, in the winter season, and to get well as soon as they feed on spring grass. The largest bile-stone, says Dr. Darwin, I have seen, was from a lady who had parted with it some years before, and who had abstained above ten years from all kinds of vegetable diet, to prevent, as she supposed, a colic of her stomach, which was probably a pain of the biliary duct. On resuming the use of some vegetable diet, she recovered a better state of health, and formed no new bilious concretions. M. Durande, a continental practitioner, affirms that he has cured all whom he met with suffering from gall stones, by a mixture of ether and spirit of turpentine; and Dr. Beddoes talks in high terms of a composition of soda and soap in the form of pills, as a remedy for gall-stones. If these medicines are endowed with the faculty of dissolving the concretions, it must of course be by a slow process, and they must therefore be looked upon rather as preventives than remedies. It is possible that the benefit attending the continued use of nitric acid in some kind of stomach pains may have some connexion with this counteracting power, and that both the pure alkalies and the mineral acid may thus serve as conservatories against the calculary tendency in the habit. It must be recollected, that although we have described the cases of gall-stones, which in their passage are accompanied by very excruciating pain, these concretions may, and do often pass of such comparatively small dimensions, and probably often of such yielding consistence, that pains of a much less violent degree are induced by their transmission, and which appear in the shape of cramps and spasms about the stomach attended by a jaundiced color of a very slight and transient nature. From the too hasty absorption, says Dr. Darwin, of the thinner part of the bile, the remainder is left too viscid and crystallised in lumps; which, if too large, obstruct the ductus communis choledicus, producing pain at the pit of the stomach and jaundice. When the indurated bile is not harder than a boiled pea, it may pass through the bile-duct with difficulty, by changing its form; and yet these viscid lumps of bile may afterwards dissolve, and not be visible among the fæces. The following observations of Dr. Heberden on this subject are worth attention. 'Among the various maladies,' says this observant physician, 'to which the human body is obnoxious, none are more frequent than pains about the stomach, which, if I am right in my judgment, do not seldom originate in a concretion of the bile (à bile concresente, vel coacta), although such concretions have not been equal to plugging up the bile-ducts, and producing jaundice. It is a long time, he says, that I have been induced to entertain this suspicion, and the observation of each passing year has served to confirm and strengthen it. For several individuals, who for months or years had suffered from this pain, I have known eventually to become affected with actual jaundice. On this account, he goes on to say, when I have observed such pains accompanied by a sense of weight about the stomach, which I have not been able to trace to any other source, I have conceived a tendency in the bile to inspissation, and I have in consequence ordered emetics, and the use for some time either of saline purgatives

or other aperient medicines.' Now it is in such semi-kind of concretions as these, if we may use the expression, that the protracted administration of either soap and soap pills, or the nitric acid, may exercise a preventive efficacy against the full formation of true biliary calculi; and generally, in instances where we have suspected the states in question, we have employed the soda pills especially with this intention; but we certainly are short of actual demonstration that the objects we desire to accomplish are thus effected. 'Tanto tamen opus est, ne nimium fidamus his rationibus,' says the author whom we have just quoted, when treating on the head of biliary preventives or solvents; and we must confess a greater disposition to side with him than to join in the enthusiastic encomiums of M. Durande.

In long protracted cases of jaundice, especially when the disorder is accompanied with much hepatic affection, and broken down energies, it is not seldom that discharges take place from the bowels that appear to consist of vitiated biliary secretions mixed with blood poured out from the meseraic vessels. This state of things would constitute the melæna of authors, and is named by the vulgar the black jaundice; considerable danger always accompanies this expression of disease, not so much from the loss of blood, or the extent of discharge of any kind from the bowels, as that it indicates a bad state of things internally, and is often indeed a mark of much visceral disorganisation. Its remedies are such as have already been spoken of under *Hæmatemesis.*

As this is the jaundice of old age, so is there one of infancy; which is, however, for the most part, of a trivial nature, and short duration; it is often caused by a retention of the meconium, and relieved by those gentle purgatives which remove the meconium from the bowels.

We here subjoin a summary of the remedial indications of jaundice, taken from the Compendium of which we have in the course of the present article made so much use.

'The great object of practice will be, to cause the bile again to flow freely into the duodenum and through the intestines; the cause of the obstruction must, of course, be sought for; if much pain is present, opium is loudly and imperatively demanded. From twenty to thirty drops of the tincture, or two grains of the solid opium, may be given every second or third hour, or oftener, till the pain subsides; and, although inflammation be not present, a preliminary bleeding may be sometimes advisable, in order to make way, as it were, for the free and full action of the opiate. Warm fomentations to the abdomen must be had recourse to; and, after the pain may have somewhat subsided, cathartic pills may be administered. These are the remedies for the active and painful form of the disorder. The more gradual and less acute kind calls for emetics and purgatives, and biliary solvents, according to circumstances. In the icterus mucosus, emetics are often exceedingly useful, they are best formed of ipecacuan; and in chronic cases of jaundice it will be sometimes found expedient to keep up nausea for some time. Blisters on the region of the liver, and sparks of electricity drawn over the right hypochondrium, have been known to emulge the bile, and cure jaundice when other measures have failed; when, as is often the case, a degree of chronic inflammation has been induced in the liver, from the interruption caused in its functions, the remedies directed under the head of *Hepatitis* are to be resorted to. Pills of soap and soda, equal parts, continued for some length of time, and combined with bitters and the taraxacum, have proved advantageous in correcting chronic jaundice. Turpentine, also, with ether, has been thought by some specifically operative in resolving biliary concretions. When the icteric disorders continue from mere debility, steel, with small doses of purgative salts, will be found of service. Thus Cheltenham waters prove beneficial to the semi-icteric state, that is connected with a chronic disorder of the liver, brought on by residence in tropical climates. Raw eggs are recommended by many, to be taken freely, when the purpose of the practitioner is that of procuring a deobstruent operation. The copaiba, too, which may be mixed with egg, is administered with the same intention.

℞ Copaibæ ♏ xxv.
Vitelli ovi q. s.
Spiritûs ætheris nitrici,
Spiritûs sulphurici, āā f. ʒß
Syrupi simplicis f. ʒj.
Aquæ puræ f. ℥iß.
Fiat haustus; bis terve in die sumendus.

Take of copaiba balsam twenty-five minims, yolk of egg a sufficient quantity, spirit of nitric ether and of sulphuric ether of each a fluid half drachm, simple syrup a drachm, water a fluid ounce and a half. Make a draught to be taken two or three times a day.

427. Class 4. Locales. Local diseases.—With jaundice Cullen's third class terminates, and with this also very nearly terminates our connexion with the nosology. It has already been remarked that the very notion of local disorder, excepting in cases of accidental lesion of structure, is in some measure an erroneous one, and, at any rate, most of the orders and genera included in the class locales, are subjects rather to be treated of in the article Surgery than requiring much discussion in this place. Thus the genera caligo, amaurosis, dysopia, pseudoblepsis, all disordered conditions of the visual organ, are disorders which are principally referred to the surgeon; the same may be said of the three following genera, dysecoia, paracusis, and anosmia,—the first two having to do especially with the ear and its appendages, the third with the nasal organ; the genera agheustia depraved taste, and anæsthesia deranged feeling, as it regards touch, are obviously referrible either to some disordered condition of the organs of taste and touch, over which the physician has not much control, or they are accidental expressions of other general or radical ailments, such as paralysis, which have already been dwelt upon.

428. On bulimia, or an inordinate appetite, we shall use the freedom of extracting from Dr.

Good, partly because the highly marked cases which occur of this disordered condition are objects of some curiosity, and partly because the remarks of our author on the bulimia of habit and idleness are well worth the regard of those for whom they are intended.

There are many persons (says Dr. G.) who from birth, or a particular period of life, without any habit of indulgence, are capable of taking into the stomach an enormous quantity of food, and cannot be satisfied without it, from a constant sense of faintness and inanition; and who by no means increase in bulk in proportion to the quantity swallowed; being often, on the contrary, slender and emaciated.

It is difficult to account for this effect in every case; but there is great reason to believe that in general it depends upon some error in the structure or position of the stomach, by which means the food passes out of this organ as soon as it is introduced into it. Thus Ruysch gives a case in which the diameter of the pylorus was considerably enlarged from relaxation; and there are others in which it has been changed from its natural to a lower or dependent position, in consequence of the left side of the stomach being elevated by a dropsy of the ovarium, or an enlargement of the liver. The existence of a double stomach, or of an immediate insertion of the ductus communis choledochus into the stomach, though noticed as causes by Blasius and Bonet, are more doubtful. In the hunger of general exhaustion, forming our third variety, we know it to be produced by the secretion of an extraordinary quantity of gastric juice, by which the food is digested almost as soon as it reaches the digestive organ. And it may sometimes, as supposed by Galen, be produced by some acrimony in the stomach, exciting that mimic feeling which is commonly known by the name of false appetite.

Whatever be the cause, the quantity of food devoured by persons laboring under this affection is enormous, and in some instances almost incredible. Dr. Mortimer relates the case of a boy of only twelve years old, who, from a feeling of inanition, had so strong a craving that he would gnaw his own flesh when not supplied with food; when awake he was constantly eating: the food given him consisted of bread, meat, beer, milk, water, butter, cheese, sugar, treacle, puddings, pies, fruits, broths, potatoes; and of these he swallowed, in six successive days, 384 lbs. 8 oz. avoirdupois; being sixty-four pounds a day on the average. The disease continued for a year: and in this case we have a clear proof that the feeling of hunger did not depend upon any extraordinary secretion of gastric juice producing a rapid digestion; for the food was usually rejected soon after it was swallowed, but whether without passing, or after having passed into the duodenum, it is impossible to say. And there are other cases related by Lommius of a similar kind.

In various instances, however, the food thus voraciously swallowed does appear to be digested, and that almost as soon as taken. The case of Tarare, as related to the National Institute, by M. Percy, a surgeon in chief to the French army, is a striking illustration of this. Before his enlistment he was in the habit of devouring enormous quantities of the coarsest flesh, fruits, and roots: and, subsequently, he was found, after swallowing his own rations, to feed on the refuse of his comrades' messes, or offensive meat thrown on the dunghills; and to devour cats, dogs, and serpents. He was strongly suspected of cannibalism; and was often restrained with difficulty from the ward appropriated to the dead. He at length fled from the army before a rumor of having devoured a child of sixteen months old, which had suddenly disappeared. The alvine evacuations of this man were not immoderate: but, after gorging his stomach, he slept and sweated in torrents of perspiration, a symptom common to the disease. He fell at length into a hectic, and died of marasmus.

Voracity is often a symptom of some other affection: it will sometimes occur, in the most capricious manner, during pregnancy, often in the middle of the night, or at some other unexpected period; when the patient, with a sudden sense of faintness and inanition, will perhaps devour an inordinate quantity of almost any food that can be obtained at the moment, though in many cases there is a fanciful longing for a particular kind, as for herrings; of which Talpius gives an instance of a lady, who in this state devoured 1400 at a meal. In these instances it is probable that the urgent desire becomes a stimulus to the secernents of the stomach, and that a greater quantity of gastric juice is in consequence poured forth.

In like manner voracity and the sense of hunger occur also as a symptom in many cases of helmintha, or worms in the stomach or duodenum. But, from the emaciation which usually accompanies such persons, it is most probable that the inanition or emptiness of the stomach is here produced not by a rapid or elaborate digestion, but by an irritable state of the muscles of the stomach, which contract too readily, and force the food into the intestines before chymifaction has taken place. Dr. Burroughs relates the case of a patient in the Philosophical Transactions, who, from this cause alone, was rendered capable of devouring an ordinary leg of mutton at a meal for several days together, and fed greedily at the same time on sow-thistles and other coarse vegetables.

Among the Greeks idiopathic voracity appears to have been a frequent disease: they paid much attention to it, and distinguished it by a variety of names, but do not seem to have been very successful in determining on the nature of its cause, or the best means of treating it. The last, indeed, must be as variable as the efficients that produce it. When we have reason to ascribe it to a morbid state of the stomach, in respect to tone or secretion, purgatives, and especially those that are warm and bitter, as aloes, may be found successful. Stimulating stomachics have been found equally so; whence Galen very judiciously recommends frequent and small doses of brandy; and Riverius, of ambergris. If these do not succeed, the stomach should be kept for some days in a state of constant nausea: and with this view, as well as with that of destroying the morbid irritation on which the voracity de-

pends, opium will often be found a highly salutary medicine. If the disease be produced by worms, or any other remote irritation, it is obvious that it can only be conquered by conquering the primary affection. And if it depend on a preternatural enlargement of the right orifice of the stomach, so that the food slips away as soon as it is introduced into this organ, a perfect cure is beyond the reach of art; though some benefit may be derived from a strong external pressure so as to detain the food in its proper place.

The second variety resulting from a gluttonous habit is far more common, and very rapidly produced; insomuch that there is not perhaps a corporate town in the kingdom that does not offer abundant examples of it. It is in fact one of the numerous evils to which idleness is perpetually giving birth: for let a man have nothing to do, and he will be almost sure, whenever he has an opportunity, to fill up his time by filling up his stomach: and hence the lazy train of servants that vegetate from day to day, almost without locomotion, in the vestibule, hall, and other avenues of a great man's house, eat three or four times as many meals as their masters, who may possibly be employed, from morning till evening, in the courts of law, the committee-rooms of parliament, or in a fatiguing maze of commercial transactions.

In tracing the cause of this voluntary disease we have no difficulty whatever. When the stomach becomes accustomed to distension it is never easy without it; and at length requires to be constantly full to be free from disquiet. It is also well known that every sense grows more acute the more it is employed: and hence the taste and longing of the glutton become more alive to what is relishing and savory: he enjoys such indulgencies more than other men, and turns with disgust from foods that are plain and simple: on this account the difference between the craving of a pampered appetite and that of real hunger is extreme. The former, whatever be its longing, can only satiate itself on delicious and high-seasoned dishes; the latter is content with a fare of any kind, and enjoys the plainest more than the richest.

It is not often that we are asked to attempt a cure of this complaint: it generally proceeds till the tone of the stomach is exhausted by its hard labor, and the cure is effected by the introduction of dropsy, or some other disorder worse than itself, which effectually extinguishes all appetite whatever. The man, nevertheless, who would honestly undertake to reclaim himself from this mischievous habit, and to acquire a better, should proceed in his career gradually; for organs that have long been under the influence of perpetual excitement, would lapse into atony upon the sudden adoption of a severe counterplan. The food should gradually be plainer, less in quantity, and repeated at a greater distance of time; while the intervals should be filled up with some pleasant and active pursuit that may wholly engross the attention; for the surest way for such a man to produce faintness, flatulency, and uneasiness in his stomach, is to think about it. The bowels will at first perhaps be costive: but this may easily be remedied by occasional doses of the warmer and bitter purgatives, as aloes, colocynth, and rhubarb; which will operate as usefully by their tonic, as by their aperient qualities.

The voracity produced by an exhausted state of the system is rarely of difficult removal; for, in general, it requires good plain food, and abundance of it. It is most usually consequent upon rapid growth of the body in the period of youth, fevers, excessive discharges, especially from the bowels or blood-vessels, long fasting, severe and uninterrupted exercise, and particularly the union of the last two, as often occurs in shipwreck, or the retreat of an enemy: it happens not unfrequently that in such cases the stomach occasionally overloads itself, and throws back some part of what has been swallowed. But this is of little importance, and often proves serviceable, by more effectually inculcating moderation than can be accomplished by medical precepts.'

In respect to the several disorders which follow the stomach affections, in this order of diseases, we shall here content ourselves with transcribing the following remarks, to be found in the Compendium of Medicine, to which we shall add those introduced likewise under the second section of this order; and as to the remaining items in this class, they will either be found, as we have above intimated, incidental manifestations of other maladies, and as such, to have already been treated of, or they will immediately be referred to in the appendix to the nosology; or else they are such derangements as, in the present day, are placed in the hands of the surgeon.

The intimations to which we have above alluded, are the following:—

429. *Lasciviousness.* Satyriasis. Nymphomania.—These ailments, connected with sexual peculiarities, often require a good deal of delicacy and discernment from the practitioner; many are the instances in which physical states have been considered moral derelictions; but, on the other hand, we must be careful of not running into the medical materialism of placing every thing to the charge of organic necessity. A proper regulation of the mind and moral sense will often do wonders. Let the feelings of the practitioner, however, always bear towards the material and merciful side of the question; and let him be ready to comfort the patient, whose organic disorder shall be kept up and increased by the erroneous conception, that he or she in being the subject of such disorder is then and therefore criminal.

430. *Anaphrodisia.*—This is often an imaginary affection and creates great uneasiness to the party or parties concerned. Dr. Darwin records two cases of youths who committed suicide under the erroneous conceit of being impotent; and John Hunter relates a most instructive case in which temporary and merely imaginary want of power was overcome by a medical manœuvre. It will be for the medical practitioner, when consulted on these distressing occurrences, either to do as Mr. Hunter did, cheat his patient into a proof of power, or give assurances that the feeling and fear are mere hallucinations resulting from morbid delicacy and apprehension.

Respecting nostalgia, or a vehement desire of revisiting the land of our nativity, we have already remarked upon the strangeness of its locality in the nosology. It is curious that the Swiss peasantry are more affected with this feeling than those of most other countries. Dr. Darwin, whose Zoonomia contains much of what is exceedingly interesting, mixed with a great deal which is extravagant and false, makes the following brief remarks on the Maladie de Pais, or nostalgia, with which we shall conclude the present section of the present article.

An unconquerable desire of returning to one's native country, frequent in long voyages, in which the patients become so insane as to throw themselves into the sea, mistaking it for green fields or meadows. The Swiss are said to be particularly liable to this disease, and when taken into foreign service frequently to desert from this cause, and especially after hearing or singing a particular tune, which was used in their village dances, in their native country, on which account the playing or singing this tune was forbid by the punishment of death.—*Swingerus.*

Dear is that shed to which his soul conforms,
And dear that hill which lifts him to the storms.

PART V.

APPENDIX TO THE NOSOLOGY.

431. 'On the subject of worms, acute hydrocephalus, calculary disorders, and cutaneous affections, the nosology and first lines of Cullen will be found defective; while vaccinia, angina pectoris, and tic douloureux, are affections in respect of name and especial investigation posterior to the time of our systematist.'

Of worms, it will be seen, we have already treated, by extracting from Dr. Hooper's Vade Mecum the section which he devotes to their consideration; in that extract will be found very many prescriptions for the best form of vermifuge; but we might perhaps have added, from another author, that, after all, the counteraction of the condition upon which worms depend is the great business to be aimed at; and this is to be effected by change of air, change of scene, change of diet, and whatever breaks in upon those habits with which a wormy tendency has associated itself.'

Of hydrocephalus we have also taken an opportunity of treating in the third class of diseases; although, upon any other principle than that of its being a scrofulous or lymphatic affection, its consideration would have been there misplaced; but the nosologist, we have again and again said, finds insuperable difficulties to contend with when he endeavours to make place, and name, and order, conform with his premises; and 'even an anatomical arrangement of morbid affection, would, under the present circumstances of our pathological knowledge, leave some of the most important disorders untouched by its embrace.'

On calculary, cardiac, and cutaneous ailments, we now proceed briefly to comment, leaving the more particular notice of them to the articles Urea, Skin, functions, diseases, and management of, and Physiology, in the alphabetical course of the present publication. On Vaccinia too, as demanding very particular consideration, we defer our remarks till the occurrence of the word in its alphabetical order.

432. *Calculus.* Stone and gravel.—Inflammatory affections of the kidneys and bladder have already been commented on; and the diseases which we are now to notice very often produce these. Indeed there is not a more frequent source of inflammation in some portion of the urinary organs than calculary concretions; on the other hand, however, it ought to be recollected, that the passing of a considerable concretion through the ureters is often productive of excruciating pain without any inflammation being excited. But we are now to turn our attention to the nature and composition, and modes of affection, and counteractives, of these concretions themselves; and we proceed to offer a remark or two on the peculiar symptoms of the stone and gravel:—

We may observe, in the first place, that the existence of calculus in the bladder, is for the most part accompanied by less derangement of the general health than the same quantity of local irritation engenders when produced by other causes. This mark of distinction is especially insisted on by Dr. Heberden, and with extreme propriety. Thus if we have bloody urine, if we have mucous discharges from the bladder, if we have difficulty and obstruction in the passage of the water, and pain about the back, testicles, and groin, as indications either of a diseased prostate, an irritation of the mucous membrane of the bladder, or from any other source than that of stone, we find always that the whole system sympathises much more than in stone with the local complaint. Thus we have wasting of the flesh and strength, hectic fever, disrelish for food, rigors, and such like attendants upon these states of disordered action; whereas in calculous pains and irritations the patients, during the intervals, are often as free from any signs and symptoms of disease, as if they were in the enjoyment of perfect health. A frequent mark of stone in the bladder is the discharge of urine tinged with blood, without any accompanying mucous or purulent admixture: this, again, is an unfrequent case in respect of other irritations, which, if they are sufficiently great to produce bloody urine, at the same time occasion also in a greater or minor degree muco-purulent discharges. The motion of a carriage or of horse-back exercise almost invariably excites or increases pain from stone in the bladder, which is by no means so common in respect of other irritations. Tenesmus or a frequent desire to discharge the contents of the lower bowel, most usually attends enlargements of the prostate gland in consequence of the immediate connexion of this gland as far as situation is concerned with the rectum; this tenesmus is not an invariable, nor even a very frequent, accompaniment of stone. Pain and difficulty in discharging the urine is a very usual mark of calculus, and so it is of other affections of the urinary organs, but in these last the pain is almost constantly perceived at the commencement; whereas in stone it is almost invariably during the discharge or just as the

micturation is concluded, that the obstruction and pain are most troublesome. It is to be recollected that the prostate gland itself is sometimes the seat of stone, as well as the subject of inflammation and schirrus, and in this case the diagnostic marks are somewhat more difficult still to trace. 'A decisive diagnostic,' says Dr. Marcet in his Treatise on Calculus, 'is still wanting of the presence of stones in the prostate. Some practitioners consider the circumstance of the uneasiness being much increased by riding in a carriage or on horse-back as the best discriminating symptom of a diseased prostate; but similar symptoms being often occasioned by stone in the bladder, they cannot alone lead to any positive conclusion. But I have heard of an instance, under the observation of Sir Astley Cooper, in which this pathological point was clearly decided by manual examination. A gentleman about twenty-one years of age became subject to a suppression of urine, for which Sir Astley was consulted. Upon passing a catheter, a grating sensation was felt at the neck of the bladder, and the finger being introduced into the rectum, some calculi could be felt moving in a cyst within the prostate, and a distinct clapping could be heard as their surfaces were pressed together. It was proposed that a small incision should be made through the rectum into the prostate, for the purpose of extracting the calculi, but the gentleman would not submit to the operation.' Into the further particulars of this case it would be carrying us beyond our province to enter; and we shall conclude by urging the necessity of minute attention to all the bearings and circumstances of the case, previously to the predication of an opinion on the existence or not of calculary concretions in the urinary bladder; and of the several species and varieties of these concretions we are now briefly to treat. The following is the division of these concretions which was proposed some time ago by Dr. Wollaston, who paid a most minute and scientific attention to this subject:—1. Scheelian uric, or lithic calculi, composed of uric oxide, or urate of ammonia. 2. Fusible calculi, which are formed principally of the phosphate of lime, and the triple phosphate of magnesia and ammonia. 3. Bone earth calculi, which are made up entirely of phosphate of lime: and these three let it be observed, especially the first or the lithic calculus, are by far the most common. The mulberry calculus is added in this arrangement, so named from its external appearance, which is principally composed of oxalate of lime. 'Urinary calculi,' says Dr. Monro, junr., 'may be divided into five classes; the first includes those composed of uric acid and urate of ammonia; the second such as consist of phosphate of lime and the phosphate of ammonia and magnesia; the third class consisting of oxalate of lime and silica; the fourth contains a proportion of urate of ammonia; and the fifth includes those calculi which are composed of cistic oxide. Besides the above substances,' Dr. Monro adds 'urea and animal matter enter into the composition of urinary calculi; the latter of which cements together the other ingredients. There are very few urinary calculi,' he further adds, 'which consist of only one ingredient.' Dr. Marcet observes in his Treatise, 'Upon the whole the different kinds of urinary calculi may be arranged under the following heads:—1. The lithic calculus. 2. The bone-earth calculus, principally consisting of phosphate of lime. 3. The ammoniaco-magnesia phosphate or calculus, in which this triple salt obviously prevails. 4. The fusible calculus, consisting of a mixture of the two former (more frequent). 5. The mulberry calculus, or oxalate of lime. 6. The cystic calculus, consisting of the substance called by Dr. Wollaston cystic oxide. 7. The alternating calculus or concretions, composed of two or more different species arranged in alternate layers. 8. The compound calculus, the ingredients of which are so intimately mixed as not to be separated without chemical analysis. 9. Calculus from the prostate gland.' The lithic calculus, the earthy phosphates, and the mulberry calculus, being by far the most usually found, we may just observe that the first is brown and smooth, and uniform, and generally of a flattened oval figure: the earthy phosphates are generally of a grayish-white and are less compact; the mulberry calculi are nearly black, and they are of a protuberant irregular shape.

Of the tests of each.—These we shall principally extract from Dr. Marcet. 'Take a fragment of the stone which you suppose to be formed of lithic acid, expose it to the flame of a blow-pipe, it will if thus constituted immediately blacken, emit a smoke of a strong characteristic odor, and be gradually consumed. Secondly pour upon the fragment in a glass vessel some caustic or pure alkali, and by the addition of heat it will be readily dissolved. Lastly, if to a small particle of lithic calculus, however impure, a drop of nitric acid be added, and heat applied, the lithic acid disappears.' The phosphate of lime calculus may be easily identified by first blacking before the flame of the blow-pipe, but soon afterwards becoming perfectly white, and not like the other exhibiting any appearance of fusion unless the most intense heat be applied. This calculus is readily soluble in muriatic acid. The ammoniaco-magnesia phosphate will have its ammoniacal portions disengaged by the heat of a blow-pipe, and the remaining phosphate of magnesia becomes opaque, and is capable of undergoing an imperfect fusion. This calculus is more readily soluble in dilute acids than even the phosphate of lime. The fusible calculus is easily distinguished when exposed to the flame of a blow-pipe, by melting, bubbling up, and running into globules of a pearly appearance. This likewise is readily dissolved by acids, and particularly by the dilute muriatic acid. The mulberry calculus is often abundantly distinguishable by its external appearance.' Its most obvious chemical character is to swell out when exposed to heat, and to expand into a kind of white efflorescence, which when brought into contact with paper stained with the juice of violets and slightly moistened, turns it green. The cystic oxide may be distinguished by its peculiar waxy appearance, and by its peculiar smell when heated, and the great solubility of its substance both in acids and in alkalies. Not

then to go any farther into the minutiæ of chemical composition by which these concretions are characterised, it is proper again to call attention to the leading distinctions of solution in an acid or an alkaline medium. Suppose it admitted, that, by administering a certain quantity of alkali in any form by the stomach, we could insure the arrival, so to say, of a definite quantity of that alkali to the kidneys and bladder, it might be concluded that were we prescribing for a mulberry calculus we should be doing no good, inasmuch as this is not acted upon by alkalies as just stated. But further, supposing that the offending matter which we wished to soften down or dissolve, to be made up principally of the alkaline phosphates, we should it has been said, in that case, not merely be throwing away our medicinals, and teazing our patients to no purpose, but we should be actually doing something worse, and positively furnishing the calculus already formed with a fresh pabulum for growth and increase: whereas, thirdly, if the concretion be (as it confessedly in the great majority of cases is), the lithic acid, alkaline solvents would then be proper and efficient.

With respect to the constitutional disposition or exciting causes which combine to effect these several concretions, we still remain much in the dark. It seems, indeed, still to be a disputed point, as in the case of diabetes, whether the altered affinities which are brought into play, in order to evolve these depositions from the urine, commence primarily in the stomach, or are the result of some particular undefined action in the urinary organs, or in the circulation; or whether the stomach affections which are so commonly attendant upon renal derangement be consequent upon, or the causes of such derangement. And, in regard to the exteric cause immediately productive of them, nothing certain has been ascertained. The drinking of hard water has been accused of having an influence upon their formation, but, beside that these concretions are widely different from any compositions of the several mineral or earthy springs, we find in fact that individuals are quite as subject to them who live constantly upon soft, as those who all their lives drink what are termed hard waters. Calculous affections are hardly known in the tropical climates, where the skin is kept in much more activity than in colder regions, and this has led to the preventive indication of attending to the external surface and keeping up cutaneous discharges. Of the prevention, however, of these concretions we know nothing more (nay, perhaps this is hardly ascertained) than that substances taken into the stomach, which are calculated to derange its functions, and thus to engender acidities, are calculated in the same measure to encourage calculous deposits in those who are either by nature, or by some undetected causes, obnoxious to such maladies. And with respect to the remedies there is much doubt in the minds of several of the medical profession, whether we are possessed of any specific or radical counteractives, even in the present state of our advanced knowledge in reference to their chemical composition and solvents. On this head, however, there may be some scepticism arising out of indolence; and it certainly does appear wrong to abandon calculous patients to their fate, merely because medicines have often proved inefficient or even worse than useless. The question of the efficacy of calculous solvents, when taken into the stomach, would appear nearly to be resolvable by the determination of another problem, namely, whether it be possible for alkaline, acid, or any other substances to pass unchanged to the urinary organs? Now, it is a remarkable fact in the animal economy that certain substances shall be taken into the stomach, shall circulate with the blood in a kind of latent state, and shall afterwards by secretory action, especially by the secretory action of the kidneys be made to develope themselves. This takes place certainly with regard to alkalies, which have been actually found in the urine by direct experiment, after a long course of alkaline medicines has been taken into the stomach, and the probability is that the same effect is operated upon the urine by the reception into the stomach of the mineral acids. The quantity is allowably very small that is capable of being conveyed in either case, and the solvent operation upon already formed, hard, compact, calculi, at the very least, extremely problematical; still, however, nascent concretions may be prevented from arising to any height by such medicinals, and their obvious diuretic effects, especially of the alkalies when it is proper to administer them, may in some measure serve mechanically to force away small deposits of calculous matter, and likewise tend to change the secretory action of the kidney itself. A difficulty has been suggested respecting the agency of alkalies as solvents of lithic concretions, upon the ground that the carbonated or mild alkalies have been thought equally efficacious as medicinals with the pure or caustic alkalies, whereas these substances in this their mild state possess out of the body much less solvent property. This objection, however, has been answered by stating that the carbonic acid of the mild alkalies may be expelled in the first passages, and that thus the medicine is brought to the same condition of efficiency as had it been taken uncarbonated or pure. The aereated alkalies may also be taken in much larger quantities than the caustic. The principle then being admitted that both the alkalies and mineral acids may have a remedial operation upon calculous complaints, when judiciously and appropriately employed, it becomes a further question what is the best form for the administration of either. It would appear in general best to change the alkaline carbonates for each other at times, and at other times to administer the soda or the potass in alternation, so as to obviate their possible deleterious effects upon the stomach, and prevent the disposition to inefficacy, which habit occasionally engenders. Some little time since much talk was occasioned by a proposal for a substitution of magnesia in place of the medicines more purely and properly alkaline. This substitution was first proposed by Sir Everard Home, and the grounds upon which its superiority was claimed are its being less offensive to the stomach than the alkalies, and its aperient tendency when meeting with acid in the stomach;

and these advantages it certainly possesses, but it does not seem to be able to communicate to the urine alkaline properties quite in so great a degree as the alkalies; and there have been cases in which a protracted use of magnesia has occasioned large concreted masses in the intestines, which have proved very troublesome, and even have been attended with fatal effects. It has been thought that magnesia when administered without any knowledge of the constituents of the calculus, for which it is given, may prove actually deleterious, when administered in cases of the fusible concretions, by adding, as far as its substance and principle is capable of being conveyed, to the actual mass of the body, to lessen which it had been exhibited; but the purgative and alterative action of the medicinal upon the primæ viæ may serve to counteract this effect. It is in this last mentioned calculus, especially, that the muriatic acid has appeared to be attended with so much benefit. In this species, says a modern author, which I am inclined to think is much more common than is usually suspected, the benefit obtained from an acid solvent is much more rapid than could be expected from the usual effect of reputed solvents in other species of calculus. Six drops of the muriatic acid, in water, were given to five patients and repeated every two hours. Two of them received immediate relief not only from all the distress which accompanies a common attack of gravel (as it is called) but also from a most painful restlessness, an excessive thirst, and a continued tendency to fainting, which symptoms seem in a peculiar way to attend this species of calculus. Two others of them experienced a relief as complete, though not quite so expeditious: and the fifth passed considerable quantities of the sand, loosely cemented together during the whole time he was taking the acid, under my eye; whether he was ultimately cured I am unable to say.' The above observations, it will readily be seen, apply to the uric and to the triple phosphate calculi. It will be recollected we stated that the mulberry, the next most usual form of calculus, is not acted on with facility either by acids or alkalies, and that consequently no principle of treatment hitherto detected can be brought to apply to it. Dr. Wollaston has observed 'that as this mulberry calculus consists chiefly of the oxalate of lime, and as the acid of sugar is known to abound naturally in a species of oxalis, it is probable it may be contained also in other vegetables and fruits; and therefore it may be assumed that the secretion in question would be modified by avoiding such vegetable aliments as may be suspected of yielding that acid.' The alkalies, says Dr. Marcet, may be used with advantage in this, as in the other species of calculi, to allay irritation; and they may also be possibly beneficial by combining with the oxalic acid in the primæ viæ, and preventing those displays of affinities that cause it to unite with the lime. Yet a still more beneficial effect is likely to be obtained from the use of the mineral acids which have the power of dissolving the oxalate of lime in its nascent state, and may therefore, if it do not prevent its formation, at least serve to assist its passage and ultimate expulsion from the system in a state of solution.' Upon the whole, however, it must be admitted that the alkaline principle of lithontriptic agency is that alone upon which much dependence is to be placed; and that as stomachic and diuretic, and in this way preventive, it is questionable whether the objections lie against their use to the extent that we might chemically conclude even in those cases where the concretion is not formed mainly of lithic acid; then again it is to be taken into account that a very large majority indeed are so composed.

Reviewing all that has been laid before the reader, says Dr. Wilson Philip, in a paper he published on this subject, I cannot help thinking that we have reason to believe that gravel generally originates in a precipitation of lithic acid in the kidneys, in consequence of a greater than usual quantity of another acid, generated chiefly in the primæ viæ, passing by these organs; and that the best plan of prevention is to correct the tendency in the primæ viæ to form this acid; to support by means which invigorate the powers of circulation the action of the skin by which in health any superabundance of acid is thrown off; and when we find that notwithstanding such measures too much acid still passes off by the kidneys to correct it by antacids before it enters the circulating fluids. The conclusions too of Dr. Prout are pretty nearly the same.

433. *Cardiac Disorders.*—On affections of the heart we feel that we cannot give an account at once more succinct and satisfactory, than by extracting the remarks of Dr. Gregory, which we therefore venture upon the liberty of doing, again reminding the reader that under the word STETHOSCOPE in the Encyclopædia we shall enter into an enquiry respecting the extent to which the different kinds of auscultation may be made to apply in the detection of structural and organic diseases within the thorax.

'To a disease exhibiting many uniform and characteristic symptoms, and usually considered as depending on some chronic derangement in the heart, either functional or structural, Dr. Heberden in 1768 gave the name of angina pectoris. Dr. Parry of Bath has treated of it fully, under the title of syncope anginosa. In Dr. Cullen's nosology it has received no place, although it might readily have found one next to asthma, to which, in many of its characters, it bears a strong analogy. Modern writers have added but little to the observations of the distinguished author who first described this disease.

Angina pectoris consists of repeated paroxysms of violent pain or uneasiness about the chest, occurring principally when the patient is walking up hill, or soon after eating. The feeling of pain is so acute as to make him instantly stand still and even to give the apprehension of immediate death; it is referred to the sternum, a little inclined to the left side; from this point it shoots across the breast to the left arm, and appears to terminate at the elbow. In some cases it shoots to the right breast, and passes down the right arm in a similar manner. At first the paroxysms do not last more than a few minutes, and occur only at long intervals. Gradually they lengthen and recur too with increased frequency; being brought on, not only when the patient is walking

but when sitting or lying down, and by the slightest bodily exertions, or even anxiety of mind. The duration of the paroxysms has been, in some very severe cases, protracted to half an hour or more, the face and extremities becoming pale and bathed in a cold sweat, and the patient, for a while perhaps, deprived of the power of sense and voluntary motion.

The character of the pulse during the fit is apparently subject to considerable variety. Dr. Heberden found it sometimes, though far from uniformly, affected. Dr. Fothergill reports, that in his cases it was commonly intermitting or irregular. There is always some difficulty of breathing, or at least a distressing sense of suffocation, present at the same time, and in the advanced periods of the disease the stomach becomes unusually irritable. Angina pectoris has been known to last for many years; yet the prognosis is very unfavorable. In the larger proportion of cases it proves fatal suddenly, from causes which will soon come under consideration. The diagnosis has often been looked upon as a matter of considerable difficulty, but I think without sufficient reason. Angina pectoris derives its character from symptoms present during life, and not from any appearances found after death; and, if the former are observed, the disease is at once entitled to such a denomination.

It has indeed been attempted by some pathologists to attach the peculiar symptoms of angina pectoris to an ossified state of the coronary vessels of the heart, but this is taking too confined a view of the subject. More enlarged experience will show that this state of disease is connected with several kinds of structural derangement within the thorax, though certainly this is the most frequent of them all; but, to prove that the restricted notions of the disease entertained by Dr. Parry and others are not correct, it is sufficient to state, that in many cases (and very remarkably in that described by Mr. H. Watson) a most extensive ossification of the coronary arteries existed without giving rise to a single symptom of thoracic disease. Dr. Latham, in an interesting communication to the London College of Physicians, has described two cases of enlarged liver, in which all the genuine symptoms of angina pectoris were observed. Both patients died suddenly.

This disease, lastly, has proved fatal where the most accurate anatomists have failed in detecting any morbid alteration of structure; and upon the whole, therefore, we must conclude, that angina pectoris is, in strict pathology, a chronic functional derangement of the thoracic organs, frequently associated with, but not directly depending upon, disorganisation of the heart.

The objects of medical treatment in this affection are limited to affording some degree of relief while the paroxysm is actually present, and to the avoiding as far as possible all those circumstances which occasion its renewal. With a view to immediate relief we have recourse to a small blood-letting, carminative draughts, and opiates. The more important object, of preventing the gradual inroads of the disease upon the constitution, is to be attempted by strict attention to diet and regimen, the regular use of aromatic laxatives, and the insertion of an issue or seton. All practitioners agree in the benefit which is derived from using the lightest and most digestible food, with perfect abstinence from fermented and spirituous liquors. Even in the latter periods of a protracted paroxysm, when the prostration of strength appears extreme, we are to hesitate in giving wine and cordials. The heart is here oppressed, not weakened.

Any thing that hurries the circulation is sufficient to bring on a paroxysm. The patient should therefore be cautioned to keep his mind quiet, and to refrain from all severe exercise. Flatus in the stomach and a torpid state of the bowels are so commonly found accompanying this disease, and either inducing or aggravating paroxysms of it, that the practitioner will do well to obviate, by the use of aromatics, bitters, and laxatives, any irregularity in the action of the chylopoietic viscera, which he may observe. Where sleep is interrupted, he may with propriety exhibit some narcotic—the extract of hyoscyamus for instance, or opium. Dr. Heberden says that he has known opiates given at night, in many instances, prevent the accession of a paroxysm.

The symptoms occasioned by the several kinds of structural disease of the heart and great vessels have been closely investigated by modern pathologists. Enquiries however have rather tended to show that they are obscure, than to establish their uniformity; and, as the whole subject is one of curiosity more than of practical interest, I shall be very brief in my notices concerning it.

1. The simplest, and one of the most frequent structural derangements of the heart, is dilatation, either general or partial, of its cavities. This sometimes takes place without any increase in the muscular parietes of that organ. At other times the heart is enlarged by an addition of solid substance, cellular and muscular; its cavities remaining little, if at all, more capacious than usual. The symptoms vary according to the nature of the enlargement which the heart undergoes. Simple dilatation of its cavities is attended with a sense of oppression about the chest, a full, slow, soft, or sometimes even an imperceptible pulse. Persons have lived in this state for many years. The disease goes on, in almost all cases, to produce dropsy, and most remarkably dropsy of the pericardium, and consequently urgent dyspnœa. In some instances chronic inflammation of the pericardium supervenes a short time before death, when the character of the symptoms very essentially changes. Nothing is known regarding the causes of simple dilatation of the heart. It has been observed in young persons, without any disease of the valves, or other mechanical impediment to the transmission of blood.

2. Where the heart is enlarged by increase of its muscular parietes the symptoms are nearly the same with those formerly described as attending chronic inflammation of the pericardium. There is a constant sense of struggling in the thorax, with inexpressible anxiety referred to the heart. The pulse is quick, hard, and jarring, and,

when the hand is applied to the chest, the stroke of the heart seems restrained, and is succeeded by a kind of thrilling. Such cases are truly deplorable, and much more formidable than those of simple dilatation. The bodily strength becomes rapidly exhausted, the faculties of the mind are overpowered, and the patient is debarred from every source of enjoyment. Dropsy commonly supervenes in this as in the former case. The solid enlargement of the heart is believed to be always dependent upon some mechanical impediment to the free transmission of the blood, and is therefore often found united to a diseased state of the valves. This suggests the pathological principle (warranted certainly in many cases), that, in proportion to the resistance offered to the passage of the blood, the circulating powers have their strength augmented.

3. Much importance has always been attached by pathologists to the changes of structure which the valves of the heart and large arteries so frequently undergo, and to the symptoms thereby occasioned. That in many cases diseased valves are the direct cause of various marks of obstructed circulation there can be no doubt, but it is not to be forgotten that they are often found where no symptoms had led to the suspicion of them. It is, I believe, quite impossible to ascertain with any degree of precision during life the existence of diseased valves, as separate from every other variety of disorganisation of the heart. Still more hopeless is any attempt to determine what valve or set of valves are affected. The general symptoms of obstructed circulation, by which we are led to form a plausible conjecture as to the existence of ossified valves, are, according to Dr. Baillie, frequent palpitations, a difficulty of breathing, a weak and often irregular pulse, and in some cases a disposition to fainting. To these symptoms other authors have added, and I believe justly, hæmorrhage from the lungs and dropsy.

4. Aneurism of the thoracic aorta is a frequent and most distressing state of disease. It can never be distinguished with any degree of certainty until it has attained to such a size that a tumor begins to be formed externally, accompanied with a strong pulsation. Dr. Baillie cautions us against supposing that strong pulsation in the chest indicates necessarily the formation of aneurism. It is generally attended with more or less of pain in the aneurismal tumor, shooting to the arm of the same side; and, in proportion to the advances of the disease, the breathing becomes disturbed. It sometimes proves fatal suddenly by the bursting of the sac, but in many cases the patient is destroyed more gradually by interruption to the respiration.

The unpleasant symptoms occasioned by aneurism of the aorta admit of very essential relief, and perhaps even the growth of the tumor is sometimes checked, by medicine. Repeated leeches to the chest have proved serviceable in many cases, and the application of cold to the tumor has been occasionally productive of advantage. Digitalis unquestionably possesses a very considerable power in moderating the urgent symptoms, and, if to the occasional employment of this drug is added a strict attention to diet and regimen, the patient may often pass the remainder of his days with tolerable ease.

5. Congenital malformations of the heart and large blood-vessels are of various kinds, and they have been ably described by Dr. Farre, to whose work I beg to refer for the anatomical peculiarities of the several cases. They all agree in one result—the intermixture of venous with arterial blood throughout the body. It is certainly a curious fact, that life should be compatible with such a state of the circulating system; yet it is so; and persons have been known to live for many years with it, and even ultimately to die of a disease unconnected with such a deviation from ordinary structure. The great source of mischief and danger, as Dr. Farre has pointed out, is not the mere mingling of black and red blood, but the difficulty with which the circulation is generally carried on by a malformed heart. This is connected, in many cases, with the comparatively small size of the pulmonary artery, the consequence of which is, that the full proportion of blood is not circulated through the lungs.

The principal symptom of malformed heart is a permanent blue color of the skin; from which circumstance the term blue disease has commonly been applied to these cases. The other symptoms to which it gives rise are general weakness of the whole frame, permanent or spasmodic dyspnœa, palpitation, an irregular, weak, or intermittent pulse, and in some cases coldness of the skin, and emaciation. Persons who have malformed hearts are liable to hæmorrhages, dropsical effusions, attacks of syncope or of epilepsy, and occasionally to the unequivocal symptoms of oppressed brain.'

434. *Cutaneous diseases.*—The term cutaneous, as applicable to a distinct series of morbid affections, wants something to make it very precise and definite. Certain it is, that, in the majority of those complaints which are regarded as diseases of the skin, this part of the body appears to be the principal seat of the deranged action, and the constitutional affections which are concomitant upon these external irritations seem often to be excited merely by the violence of the cutaneous derangement. When, however, these superficial marks of disease arise, as they often do, in consequence of the reception into the body of a specific morbid poison, it must of course be concluded that some sort of constitutional or general ailment precedes the local expression of the disease, upon which the cognomen is founded. This indeed is most obviously and decidedly the case in reference to the action of some of these poisons, as in syphilis for instance, in which, connected with the external signs of disease, we have internal pains and other marks denoting internal and systematic disturbance. Indeed the vulgar creed is, with regard to all affections of the skin, that they are merely indices or displays of constitutional states, and hence the notion of noxious humors and foul blood. Into this notion, we have already hinted, that some pathologists have too readily given, by the institution of an order of distempers under the denomination of cachexia, which, founded upon the Greek word κακος, signifies a bad habit of body; and, previously to the laws of secretion and excretion

having been properly recognised, it was conceived, both by the profession and by persons generally, that the marks on the skin were a sort of elimination, as it were, of this morbific matter, which, till it appeared upon the surface, was in some way or other floating about in the humors of the body. Now, that this notion is not only vague but actually incorrect, is shown by the fact that the most extensive affections shall at times exist in the exterior of the body, while the fluids of the body are free from any similar taint. It is therefore not distempered humors, but a certain species of deranged action, the actual essence of which is altogether inexplicable, which gives origin to the derangements in question. To this principle there may seem to be some exception in scorbutic and some other morbid states, where the blood appears to partake of the distemper which at the time pervades the frame; but even in these cases there is for the most part merely a want of proper constitution and crasis of the blood, rather than any chemical impregnation of a specific nature; and there are several remedial influences upon these disordered habits that, by curing the malady, alter the constitution of the fluids, which it is impossible for them to have effected by any immediate or direct operation of a chemical nature. Of mental influences as remedial in scurvy, we have already spoken. It is then, to say the least, extremely questionable whether those long processes of medicine, the fashion of which is indeed a good deal going by, that are instituted upon the notion of effecting an alteration in the mass of circulating fluids, have any more than an imaginary operation. Although, however, we must abandon the notion as untenable which hinges upon the supposition of these chemical changes in the fluids, we are compelled by observation to admit on the other hand, that there is in a great number of cutaneous irritations such an intimate connexion with constitutional and internal changes, that to repel precipitately the one is often to give rise to another morbid action. Thus let some species of skin eruption be suddenly dried up, by the employment of external astringent or repellent medicinals, and, if there be tendency in the habit to asthmatic affection, a difficulty of breathing and other indications of pulmonary ailment will often immediately establish themselves, although if you draw blood from the patient under either circumstance of affection of the skin or the chest, you will not find it impregnated with any material of a morbific kind. Cutaneous affections then are rather disordered actions than evidences of depraved fluids—this disordered action sometimes pervading the internal organisation ab origine, at other times affecting the interior merely by the violence or repression of the local irritation, and occasionally being constituted solely by a depraved action in the surface itself, the internal organs not being affected either primarily or sympathetically. Whether are cutaneous distempers susceptible of classification? To this question we should be disposed to reply in the negative, notwithstanding the recent exertions to embody and arrange this varying expression of disease. In the classes of Dr. Willan and Bateman, we find at the very outset an obvious error, inasmuch as the epithet cutaneous is made to apply both to those affections the exclusive residence of which is the skin, and also to such as are preceded by internal irritations of an obvious and active nature, and of which, as in small pox, the state of the body's surface is but one link in the chain of disordered actions. Again, the evanescent and fugacious habits of these cutaneous irritations is extremely hostile to any definite arrangement of them. The disease, for example, to which we have just referred, is, in reference to its external characters, a different affection on one day from what it is on another. We are, thirdly, so little aware of the precise nature of the morbid poison which gives rise to most of the skin diseases, that it is impossible to trace and mark their effects, but by the most arbitrary assumptions of identity; and it may be questioned, whether the descriptions of the ancients, either in cutaneous or any other disorders, are sufficiently distinct and explicit, to enable us to apply them to modern maladies, such certainly is not the case with the order of diseases to which we are now adverting; their deficiency in intelligibly notifying by actual specification these diseases being a matter of notoriety. 'Disorders of the skin,' says Heberden, 'have been variously recognised and named by the ancient writers on medicine; the respective names which they attached to them are, however, not easily ascertained in the present day, nor does it appear of much consequence to aim at ascertaining them; and the division of these affections into kinds and species, which formerly obtained, is now pretty generally discarded or neglected. It is customary to name these anomalous and nameless affections scorbutic, but still without any sufficient reason.' 'Of proper scurvy,' he continues, 'I have nothing to say; nor of the real leprosy, since the former being exceedingly rare in cities, and the latter hardly known in England. I have never had an opportunity of examining them; and with the exception of these two, the itch, the herpes, and the tinea capitis, or scald-head, seem to be the only cutaneous affections about which medical opinion appears to be unanimous as it regards names and descriptions.' Other authors make a division of the herpetic eruptions into two species, viz. the true herpes and the impetigo or ring-worm. 'In the herpetic eruption,' says Dr. Monro, 'there is a small vesicle with a thin scale at the top, and the base is surrounded with erysipelatous inflammation. Sometimes herpes appears under the form of flat patches, which are covered by small scales. This form of the disease is very common on the scalp. When the scale falls off the skin below is generally nearly sound, though somewhat discolored. The herpes appears also in the form of very small vesicles, like millet-seeds; which appear in clusters, and are filled by a viscid lymph, which exuding, forms rough yellow scabs, and when the scab falls off it is apt to be renewed. This kind of herpes sometimes attacks the throat. Another kind of herpes has been called the herpes exedens; for it destroys the skin, sometimes it spreads along the whole surface, but in other cases penetrates deep.' When speaking of the ring-worm, which Heberden includes under the

general name of herpes, Dr. Monro says, 'In this disease there are a number of small red pimples, filled by a thin acrid fluid, which are disposed in a circular manner. This disease in some constitutions becomes of an inveterate nature, and is diffused over the whole body, like the lepra.' The lepra is described by this author as a disease in which there are a number of copper-colored spots over the whole body; these are in a great measure insensible. The skin, when the disease has made progress, becomes rough and scaly, or is covered by warts; and fœtid sores sometimes break out in different parts of the body.' Tinca, herpes, psora, are Heberden's three distinct diseases of the skin. Sibbens, syphilis, lepra, elephantiasis, frambæsia, acne, are talked of by others, and we shall proceed to offer a few observations under each of the above heads:—Tinea, or as Dr. Willan calls it, porrigo, or scald-head, is formed by a peculiar chronic inflammation of the skin of the head, which prevents the proper growth of the hair, and thereby occasions it to fall off. The matter which is secreted in this complaint is capable of producing itself in the head of another individual by being applied to it, but the disease is not probably otherwise contagious. It appears, however, capable of being engendered by uncleanliness and unwholesome food. It is not for the most part difficult to cure. The hair ought to be cut away close from every part where the eruption makes its appearance, and the unguentum picis applied over the whole of the ulcerated surface. When the unguentum picis fails, the citrin ointment may be used. the ung. hydrarg. nitrat. of the pharmacopæia; this is for the most part too powerful of itself, and requires to be mixed with an equal quantity of the cetaceous ointment. The disorder usually lasts for a month or two or more. When the external applications seem to fail, or not to act with their usual power, the sulphuric acid taken internally will often prove exceedingly useful in promoting cutaneous absorption. It is scarcely necessary to say that where poverty of diet has been either wholly or partially the cause of the complaint this must be changed for nutritive and wholesome food. The bowels must be kept regular, and even purging in some cases is advisable, especially when, with the retrocession of the eruption, the glands of the neck seem disposed to swell, or the general health affected.

Herpes breaks out in different parts of the body, and is sometimes exceedingly painful and obstinate. Its local remedies are the various preparations of mercury, with which the internal use of this medicine may be occasionally combined. Warm bathing is sometimes useful by promoting a regularity in the cutaneous excretion. The true herpetic eruption, according to Willan and Bateman, is a vesicular disease (see the heads of classification at the end of the present section). The shingles is in their scheme a true herpes (herpes zoster). This disorder usually occupies some part of the body rather than the extremities, it consists of little vesicles or bladders on an inflamed base; and these extend often for some inches in length, appearing like little clusters of minute vesicles on a red pimple. It is attended with a good deal of irritation at times, when the patch of eruptions is large, but does not require any medicinal beyond that of keeping the bowels gently open; it lasts from a week to a fortnight. Respecting the vulgar notion of its fatality, should it complete the circle of the body, we need not say any thing.

The herpetic ring-worm of the head is distinguished from the porrigo or scald head. Of the psora, or itch, there seem to be at least two or three varieties; and hence the discordant accounts which we meet with in authors, on the question whether this disease is constituted of animalcula? 'The animalcula,' says a modern author, 'which are seen in the pustules of itch are the effect, not the cause, of these pustules, as all other stagnating fluids abound with them.' But Dr. Heberden tell us that he has never been able to discover these same insects in itch either as a cause or consequence of the distemper, and that other physicians have told him the same, although they have brought to the investigation microscopes of large power. Dr. Bateman imagines that the breeding of these animalcula in a scabious skin. is a rare and casual circumstance, and that the contagious property of itch consists in the fluid, and not in the transference of insects.' Dr. Adams, however, proposes a different method of reconciling these discordances, and concludes, 'that an eruptive disease, independent of the itch, is excited by an insect, called in Ireland the flesh-worm, in France the cyron, in Portugal the oucas; once well known in England by the name of wheal worm, and still sometimes occurring. That the disease which it excites from some resemblance, from situation, and from yielding to the same remedies, may be mistaken for itch; but that the insect has never been discovered in true itch, when searched for in the most marked cases.' Whether the itch is capable of being engendered by bad air, unwholesome diet, or deficient cleanliness, is another question about which there has been some diversity of opinion. There is, however, one kind of itch which has been named scabies cachectica, evidently the product of these sources, independent of contagion, and indeed, according to Dr. Adams, incapable of being propagated as a contagious distemper. Dr. Adams names this affection herpes pauperum. 'It occurs,' he says, 'in confined nurseries, if change of air is not introduced, but without extending to other parts of the house.' 'I have seen it,' he continues, 'in two or three misguided youths, who have returned to their parents after a temporary absence in the lowest order of society; in these instances it has never been communicated to the rest of the family. The more usual form, however, in which the itch makes it appearance is in the shape of small eruptions, which have for the most part little watery heads; and at other times, especially after a long continuance of the disease, these eminences become pustular, and run into one another. In this latter case the margins are slightly inflamed as in small pox. The fingers, wrists, waist, and hams, are the principal seats of these eruptions, which, however, often come eventually to extend themselves over the whole of the body. The itch is one of those affections

of the skin which may be, for the most part, to say the least, repelled with impunity; and most unquestionably the remedy of greatest efficacy in effecting this repulsion is sulphur. When this is objectionable, the several preparations of mercury may be tried, of which the white precipitate ointment is the most cleanly, and perhaps equally efficacious with any other. The internal use of sulphuric acid is often, in long-continued and inveterate cases, of conspicuous and abundant service. This has been said rather to apply to the pustular itch, and the liquor arsenicalis in doses of five or six drops, three times a day, to be more applicable to the herpetic or diffused psora. The white hellebore was formerly much in use in cases of scabies, but it is at present not much employed. Dr. Heberden concludes his chapter on scabies with the following observations:—'There are some contagious diseases, such as the small pox and measles, which only affect the system once in the course of life; others, such as the scarlet fever and the hooping-cough sometimes, although rarely, recur a second time. Some depend for their production upon the combination of certain external and internal causes, as in the examples of dysentery, camp-fever, and the plague Psora, however, and the lues venerea may always be produced by the application of their peculiar exciting causes. It is therefore to be regarded as a beneficent design in providence to have furnished mankind with specifics against both these poisons, viz. sulphur for the one, and mercury for the other; for had not that been the case the extension of the two complaints might have proved unlimited and almost universal.'

Respecting sibbens, opinion by no means appears to be unanimous; by some authors it is conceived to be a modification of the morbid poison which produces the frambæsia, or yaws; by others it is imagined to be the form in which the venereal disease first made its appearance. In the chapter in Celsus de obscænarum partium vitiis, there are several descriptions, which correspond more with the symptoms of disease called by the moderns sibbens, than they do with the true lues venerea. The following extract respecting this affection is from a work of professor Frank of Vienna:—'In 1800 a disease appeared in Dalmatia, which had the character of syphilis, but was rather considered a kind of lepra, as it was communicated not only by sexual intercourse, but also by every kind of intimate connexion. Several thousand persons were already affected, when Dr. Cambieri, district physician at Fiume, pronounced the disease, which was called by the natives scherlievo, a venereal affection, and the same with the sibbens in Scotland. In consequence of which the malady in question was not only treated with corrosive sublimate, but also its further propagation completely checked, by the erection of hospitals, and the adoption of other regulations, that in the course of three years it was almost exterminated. On this occasion Dr. Cambieri suggested the opinion that the sibbens, or the scherlievo, was the original form of the venereal disease, as it first appeared in Europe. For it is well known that it existed long before it was supposed that it communicated itself by sexual intercourse. Even the rapidity of its diffusion over all Europe, renders it probable that this was not the only way in which syphilis was then propagated.' Dr. Adams supposes that sibbens and syphilis are different diseases, although the former resembles the latter more than any other with which we are acquainted. 'The venereal ulcer,' says Dr. A., 'is attended with callous edge and base, and sibbens consists only of the clear phagadenic ulcer. The secondary local symptoms differ also; the venereal retaining longer its copper appearance, and afterwards becoming more elevated, retaining more of the color of the skin; and the scab when formed being more scaly. In sibbens the appearance is very rarely pustular, and I should conceive the pus still less in quantity than in syphilis. There is nearly the same difference between this and the venereal scab, as between the cow-pock and small-pox scabs. Lastly, it is now universally admitted, that sibbens never attacks the bones, but by spreading from the soft parts, and that it yields earlier to mercury than syphilis. This disease was a few years since exceedingly prevalent in the western parts of Scotland; but it appears to be at present on the decline, both with regard to severity and frequency of occurrence. Frambœsia, or the yaws, is a disease very common in the West India islands, and supposed generally to have been imported from Africa. Dr. Adams supposes that the leprosy of the Jews, described in Leviticus, was rather this disease (the yaws) than either the Arabian leprosy or the lepra Græcorum, and there appear some grounds for the supposition. The following is the description of this disease which is given by Dr. Thomas, who informs us that he has several times witnessed it: 'For the most part the patient complains of head-ache, loss of appetite, and pains in the back and loins, which are rather exasperated towards the evening. When these symptoms have continued for some days, they are followed by an eruption of pustules, more or less numerous, which appear in various parts of the body, but especially upon the forehead, face, neck, arm-pits, groins, pudenda, and round the anus. The eruption of these pustules is not completed over the whole body at one time. At their first appearance they are not larger than a pin's head, but gradually increase until they attain the size of a sixpence, or even of a shilling. The pustules are filled with an opaque whitish fluid, and, when they burst, a thick viscid matter is discharged, which forms a foul dense crust or scab on the surface. From the larger kinds of pustules there frequently arise red fungous excrescences of various magnitudes, from the size of a pea to that of a large mulberry. These fungi have but a small degree of sensibility: they never suppurate kindly, but discharge a sordid gelatinous fluid, which forms an ugly scab round the edges of the excrescence. When these eruptions appear upon any part of the body covered with hair, the color of this is gradually changed from black to white.'

The few words which we have to say on syphilis are merely in reference to the disorder as a cutaneous affection. The copper appear-

ance of the cutaneous eruptions in the lues venerea is their principal characteristic; they are not so phagadenic as some other ulcerations of the skin, but they appear more stationary, and are rather disposed to rise from the surface than to spread. The scurf or scab which forms over the true venereal ulcer is remarkable; and it is a very frequent occurrence to find the throat affected in conjunction with the cutaneous eruptions. When indeed this is the case, there is for the most part but little room to doubt respecting the actual nature of the disease; and, with regard to the appearance which a venereal throat assumes, it may be observed that there is a dead foul coppery kind of character in it, which, to a person who has once seen it, can seldom be mistaken a second time. One author has said that a venereal ulcer in the throat gives the appearance as if a portion of its substance was dug out, and this is not an unapt description of the appearance which it takes on. If not arrested, too, the palate and uvula come in time to be affected, so as to occasion a hoarseness in the voice. But, as we have just said, it is not within our intention to trace the progress of the venereal disease through its various stages and degrees; we shall content ourselves with merely introducing a caution against that tendency, which has become perhaps rather too determinate, to doubt the syphilitic character of actual syphilitic eruptions, and thus to forego too long the use of the only decided antidote hitherto discovered to the poison.

On the subject of lepra and elephantiasis the greatest diversity of sentiment has prevailed; and the discordant opinions in reference to these particulars do not seem as yet to be entirely econciled. In the writings of Aretæus we have very eloquent description of the disease, termed by this author elephantiasis, which commences with a description of the elephant, to which he compares the affection, or rather the subject of it. In the course of this description Aretæus acquaints us that the skin of the individual who is the subject of the affection becomes thickened and scaly, tumors and spots of various kinds break out in the upper parts of the body, the body itself becomes emaciated, notwithstanding which the face and the lower limbs swell, and, when the disease is inveterate, both the toes and the fingers become buried in tumefactions. Such is the elephantiasis of Aretæus, with which a more modern disease has lately been confounded, named by some the Barbadoes distemper. In this last disease one or both of the lower limbs is swelled to an enormous size, and the patient is sometimes free from any cuticular affection independent of this. That these two affections are distinct does not seem to admit of any doubt, but much controversy has arisen respecting the identity of the ancient elephantiasis and the lepra, described by the Arabian writers, of which Avicenna in particular speaks, 'quasi cancrum communem corpori.' Dr. Adams contends for the sameness of these two distempers, and he makes a division of the distempers in question into the Arabian or Syrian leprosy, or elephantiasis of the Greeks, the true lepra Græcorum and the Barbadoes leg. The leprosy of the Jews, we have already said, this author imagines may have been what is now called the yaws, and there is certainly a considerable correspondence in the delineated features of these two last diseases. The leprosy, of which we hear so much in the New Testament, is conceived to be the elephantiasis of the ancients, which, says Dr. A., is a chronic disease unattended with fever, and appears on most parts of the body in distinct tubercles. The scales which characterise this affection never appear but in the advanced stage of the disease, and are then only partial, while the lepra Græcorum is distinguishable by the scales being coeval with, and as general as the disease. In the one affection the elephantiasis, or Syrian leprosy, the disorder prevents the evolution of the genitals; in the lepra Græcorum, on the contrary, physical and sensual desires are extremely ardent and ungovernable. M. Sonini, in his travels through Egypt, informs us, that the subjects of leprosy are remarkable in this particular; and he mentions an instance of a leper, on the very night of his death, being hurried away even several times by the warmth of his passions. 'He further tells us, he has noticed in Canea, in the island of Candia, great numbers of lepers, both men and women, banished without the gates of the city in miserable hovels, where they abandoned themselves to the greatest excesses of voluptuous irritation. They were sometimes to be seen satisfying their disgusting and impetuous lusts in open day, by the side of the roads leading to the towns near which they lived.' Aretæus mentions this peculiarity in the elephantiasis, but Dr. Adams conceives that this feature is described by the Greek writer merely upon hearsay authority; and indeed, by his own confession, his description is taken in part from the relations of others. The true elephantiasis we are told by Adams is not contagious, but it is constitutional and incurable; and, from this last particularity in the distemper, he infers the difference between the lepra Græcorum and the lepers of the New Testament, upholding his opinion that these last were instances of the elephantiasis, and not lepra. 'That this disease,' says our author, 'was different too from the leprosy mentioned in Leviticus, and for which a temporary exclusion only was required, is evident, inasmuch as it was incurable. Am I a god, says the king of Israel, that this man expects me to heal a leper? and the cleansing of lepers was admitted among the most extraordinary of our Saviour's miracles. On the treatment of these diseases it will not be necessary to enlarge further here, than by saying, the various alteratives, mercurial, antimonial, and vegetable, have been employed, and with various reputed success. 'Although,' says Dr. Thomas, 'by paying a proper attention to regimen, and administering alteratives, we may be able somewhat to retard the progress of the disease, and thereby prolong the life of the patient; still, when the habit becomes generally tainted, all means will be likely to prove inefficacious.' In respect to the Greek elephantiasis, or Syrian leprosy, if we are to regard the affections as synonymous, it is agreed to be incurable. 'How

can we expect,' says Dr. Adams, 'to cure a disease which originates in the constitution, and which the constitution is unable to cure.' A generous diet, however, he adds, certainly protracts life, and renders it more tolerable. The treatment of the Barbadoes elephantiasis is directed principally in the first instance to the abatement of lymphatic irritation, and afterwards to support the tone of these vessels.

Of acne or spotted face there is an abundant variety. Eruptions on the face, especially on the forehead, chin, and temples, which do not extend to the body, are very common at all periods of life, but whether these distinct, hard, inflamed tubercles which are sometimes permanent for a considerable length of time, and sometimes suppurate very slowly and partially, are capable of being arranged accurately, as Dr. Willan proposes, under the varieties of acne simplex, punctata, indurata, and rosacea, admits of a doubt to say the least. The acne, or spotted face, is to be treated by internal remedies or by local astringents, according as the constitution appears to be affected, or the complaint is merely cutaneous, the symptoms characterising the one or the other state being for the most part rendered sufficiently obvious by the present state or previous history of the patient. Indeed the whole of cuticular medicine is resolvable into this principle. First ascertain how far the root of the evil exists in the interior of the frame, and how far the derangement is merely on the surface, and then proceed either to internal medicinals or to external applications.

Cutaneous absorption, or the promotion of this, is what we must always aim at in our endeavours to remedy chronic eruptions of the skin: and, when the disorders are attended with much local or systematic excitement, these absorbent powers must be such as act without much irritation, such as the mineral acids, either the sulphuric, the muriatic, or the nitric, which at the same time sufficiently stimulate the absorbent vessels of the surface, and serve to abate the prevailing irritation. Arsenic and mercurials appear to be more especially applicable to those states of the skin which are unconnected with much irritative disturbance, and in which more direct excitement is called for. We probably often increase and protract cutaneous complaints by the too indiscriminate and free use of these, especially of mercurials, from a vague notion of the alterative efficacy of these medicinals. In all affections of the surface cleanliness is one of the cardinal points upon which the treatment must turn, and we are disposed to think that independently of the one or two specific distempers and specific remedies, as mercury in syphilis, and sulphur in itch, we have not arrived hitherto at any satisfactory acquaintance with the principles of medicinal management, beyond that of exciting the excretory and absorbent power of the surface, abating local and constitutional irritation when they exist, preserving the bowels in a state of freedom or regularity, and correcting poverty of diet on one hand, and exciting, heating materials of food on the other.

It must be allowed, however, that several chronic affections of a cutaneous kind seem very much benefited by the decoction of the woods as it is called, decoct. sarsap. comp., which in connexion with Plummer's pill., the pil. hydrarg. submur., may be administered for some length of time when we find the cutaneous disorder of an obstinate nature, and when it assumes an anomalous character. Of the eruptions and derangements which are termed pseudo-syphilitic we shall have to treat in the article SURGERY.

In the course of the above remarks it will be seen that we doubt the correctness of those classifications which have been made by some modern authors, especially Willan and Bateman. It may be right, however, just to state the principles upon which these arrangements have been proposed and the classes into which the various affections of the skin are divided. The elementary terms then of Dr. Bateman, which he principally takes from Dr. Willan, are,

1. *Papula.* Pimple.—Little eminences on the skin not commonly containing a fluid, and in which he ranks strophulus or the eruptions which are common to very young children under the name of the red gum, or red gown, and tooth rash; these often appear in the healthiest children, and being attended by no constitutional derangement no medical treatment is demanded, unless indeed, under the feeling that it is right to attend to the stomach and first passages, we should be disposed to give the child a few grains of magnesia, or a few minims of sp. ammon. aromat.

2. *Squama.* A scale.—Disorders in which the cuticle comes off in the form of lamina. The lepra is one of the illustrations of a squamous as opposed to a porriginous disease.

3. *Exanthemata.* Rashes.—The febrile eruptions, such as measles and scarlatina, are exanthematous diseases.

4. *Bulla.* Bleb.—These are swellings containing a watery fluid. The nettle rash, and the vesicular disease called pemphigus, are included in this class. The nettle rash, when it is obviously caused by irritating matter taken into the stomach, requires emetics and purgatives. Beyond this, these vesicular affections are very little under the control of medicine.

5. *Pustula.* Pustule.—Common boils and distinct small pox are examples of pustular diseases. The porriginous affections are pustular as opposed to the leprous or scaly on one hand, and the herpetic or vesicular on the other.

6. *Vesicula.* Vesicle.—Some eruptions, instead of proceeding to pustular suppuration, continue vesicular; the vaccine disorder is more vesicular than pustular. Shingles are vesicular.

7. *Tuberculum.* Tubercle.—This, like the papula or pimple, is a flesh eruption as opposed to the pustular or vesicular, but the swelling is much larger. Acne, or spotted face, is an instance of a tubercular eruption.

8. *Macula.* Spot.—This designation merely points out discolored skin, as in the nœvi materni.

9. *Wheal.*—This has somewhat the character of the bulla or bleb, but it is not so permanent, nor does it contain a fluid.

10. *Furfur.* Scab.—Scurfy exfoliation, as in the disease called pityriasis, which consists of a yellowish color of skin extending over the prin-

cipal part of the body, the cuticle coming off in bran-like exfoliation. It lasts often for months or years, and does not seem to be much under the influence of medicine.

11. *Scab.*—Hard cuticle forming itself over superficial ulcerations.

12. *Stigma.* Specks.—Several together forming petechiæ.

435. *Tic Douleureux.*—Respecting the pathology and precise nature of nearulgia facialis or tic douleureux very little can be advanced that is satisfactory. Its seat is usually on the cheek bone, and it affects in a manner quite peculiar; for, beside that the pain is extreme and intolerant, it is accompanied by twitchings and convulsive darts, from which the name tic has been derived; and it is usually as protracted and obstinate as it is painful and peculiar.

Some have endeavoured to account for this affection by supposing it to be an inflammation of the neurilima, investing the particular nerve that is its seat; but its mode and manifestation seem inconsistent with the notion of inflammatory disorder even of the most chronic kind; and to attribute it to a particular condition of the brain is quite vague and nugatory, for it often lasts for years without the cerebral system seeming to be at all affected, and, even when comatose affection supervene upon it, one should rather incline to the inference that these last depended upon some altered condition of the nervous organisation and functions consequent upon the intensity and protraction of the disorder, than that the disorder resulted from the condition of the brain.

The remedies too seem inconsistent with the cerebral pathology of the malady; for nothing certainly has come so near to a specific operation in this complaint as very large quantities of those medicinals which go under the denomination of tonics; arsenic bark, and more especially carbonate of iron. We have seen cases, which, to say the least, came nearly up to the full malignancy of the disorder that have yielded to the carbonate of iron in drachm doses, repeated three times a day; and it would, we think, be right in all nascent affections menacing the actual establishment of neuralgia facialis to make trial of this last mentioned drug. All the narcotics, such as opium and henbane and hemlock have been tried without affording any thing beyond a temporary relief; even the division of the affected nerve has proved unavailing, and a most rigid attention to dietetic rules has been enjoined and practised under the notion of 'digestive organ' derangement, without at all fulfilling the expectation of prescriber or patient.

In concluding the present article it will scarcely be necessary to point out the books which the student of medicine will find his account in consulting. The use which we have made of most of the modern authors, who have written systems of medicine, is a proof of the value we set upon their labors. Indeed we have been fearful sometimes of transgressing even encyclopædian license by transferring sections of books into our pages. If, however, we have largely borrowed, it will be admitted that we have liberally acknowledged, and we should hope rather to have promoted the circulation, than interfered with the value, of the several works that have contributed towards the composition and compilation of the present article.

It will all along have been seen that we have been anxious to impress the peculiar nature of medical researches, and the different circumstances in which a student of medicine is placed from that of an enquirer into any other branch of science. It will have been perceived also, that, without regard to the restriction of uniformity, we have dwelt upon some parts of our subject more fully than others; thus on the head of nervous and mental ailments we may be considered as having entered into more detail than consisted with the limited and practical manner in which other affections had been discussed; to this we have perhaps been partly led by the feeling that our readers are not expected to be exclusively professional, and we have therefore been desirous of branching occasionally out from the dryness of mere detail, into something rather speculative, and of general interest.

But we will not conceal that our intention has further been to assist in freeing the science from the fetters of mere technicality, and to enforce the conviction that neither a combination of anatomical and physiological knowledge, nor a full acquaintance with disease and antidotes in a routine way, will suffice to form the philosophic and efficient practitioner of medicine.

We have already, in the introductory portion of the present treatise, introduced some few remarks from a sensible writer, Mr. Mansford, bearing upon this point, and we have the highest satisfaction in concluding the paper by presenting an extract from a little work which has been sent to us from our friend Dr. Stewart, the author, while these pages have been passing through the press. This little book, entitled On Tendency to Disease of Body and Mind, &c. strikes us as containing in a small compass much that is admirable in matter, joined with a singular felicity and impressiveness of manner; but the reader shall judge for himself.

'It must be always borne in mind, when we consider the different manifestations of mental or corporeal power, that it is not in the object or subject of any action, that the great virtue lies, but rather in the passion or function that grapples with it. Food and drugs have, in themselves alone, no more strength or operation, when applied to the lethargic or unwilling stomach, than a book or engraving has, when laid before the gaze of an untutored savage. Their admiration is merely the opportunity or occasion, upon which the vital energy is called into play; and it is the functional power, not the passive capacity, of any organ which is to be considered. Whether the application be made to the internal surface of the alimentary canal, or to an ulcerated extremity, it is still the living fibre which is excited and interested. For, though necessary to the transactions in which they bear a part, any articles of diet or medicine are subservient to various controlling powers, and can of themselves do nothing; neither are they in any sort of ac-

cordance with the phenomena to which they administer. Vitality bids defiance, to a certain extent, to chemical and mechanical laws, or at least regulates and overrules their sway; and its deficiency is always best estimated by the resistance which these last maintain, on some occasions, in opposition to it. This peculiar power is nevertheless bounded. Certain general laws hedge in the widest irregularities, and establish something like constancy in the occurrences belonging to natural functions. For instance, in digestion, the instrumentality of various organs is required, and these are more or less affected and disciplined by circumstance and habit; and then the subject matter must contain certain elements of nutrition, and be free from an excessive proportion of crude or poisonous alloy; but, after all, whatever be the diet, and whatever the precautions used as to time and preparation, it is still this unseen power of vital energy which acts and governs, and in fact, 'makes the food it feeds on.' If we look merely to secondary phenomena, without tracing them to their primary source, we shall not account for the condition of any one of the living functions. An explanation of the ultimate stages of digestion and assimilation will in vain be sought in the most scrupulous analysis of the quality, and in the most exact admeasurement of the quantity, of esculent substances, if at the same time the disorder or well-being of the complicated apparatus which is brought to bear upon them, be not estimated. How else shall we explain the impunity with which people in vigorous health feed upon the most indigestible fare, the dura ilia messorum, compared with the irritation which the simplest and properest food occasions, when the stomach is debilitated or diseased?

We draw from the foregoing considerations, that all the agents or circumstances which modify the living powers have not a direct or positive, but only an indirect or relative operation. It is their fitness and expediency, their practical effect, not their inherent virtue, and abstract definite qualities, which recommend them to our notice. For instance, when in the treatment of an injured joint, rest is enjoined at one period, on account of inflammation, and then motion is ordered, at another, to keep up the proper uses of the part, neither plan is of itself good or bad; but we have an example of the legitimate agency of the healing art, which alternately interferes or looks on, as it is judged proper to check the tendency of vital actions, or to trust entirely to them. In this way alone can we account for the remarkable similarity of effects brought about by causes very different in their nature and mode of operation. We know that, in the treatment of many diseases, it is now a minute dose of a poison, now a total change in the habit of life, which sets up a new action in the system. At one time the most active unremitting supply of corroborants is demanded, as in purulent discharges; at another, a total suspension of human agency, as in encouraging union by the first intention.

It is not possible to deny the truth of this statement without refusing credence to the majority of writers and speakers on all occasions of professional conference and consultation; and without taking a very partial and limited view of the laws of physiology, pathology, and therapeutics. But if we duly consider under what different circumstances the same series of external phenomena may exist, how different may be the conditions of the vital energy, and how various the aptitude of the inherent powers of the system, to profit by any opportunity of re-establishment; we shall be much less puzzled to explain these apparently discordant facts. By considerations such as these we can easily subdue all tendency to pyrrhonism, reconcile discrepences which would else appear startling, and account for various revolutions in theory and practice totally inexplicable in any other way. Hence, too, we learn to study, rather the varied applicability of remedial agents, than to confide in their specific power. We must, it is true, from our limited powers of penetration and comprehension, and from the influence of habit, look with more favorable eyes upon those instruments which we have proved, and be inclined to account for their efficacy upon principles which we have deduced from actual trial, or from the common fund of experience and observation. But, without denying the utility of a system of professional orthodoxy, we should be cautious of attaching ourselves with so much bigotry to any favorite class of remedies, as to exclude all others from their rank as auxiliaries. Our art should be, like the system which it aims to preserve, living and progressive; and we should learn not only what, but how to think.

We are then all prepared to admit that there must be causes operating which we cannot appreciate, and to acknowledge the assistance which we must always derive from the general laws which control life and health, and recovery from disease; but it is also certain that so long as we have the power of stepping in to alter the direction of the vital processes, and to originate new actions in the system, we are untouched by the suspicion of the vulgar, who, ignorant of these principles, frequently consider the medical practitioner inefficient when he is really exercising the greatest skill, and promoting the most beneficial results. In these matters, as in most others where we are vitally concerned, we can obtain only moral evidence, and must not expect demonstration. There is a balance of probabilities to be decided only by a majority of proof. In new and isolated cases, therefore, we have analogy only as our guide; and proceed with less satisfaction and confidence than in those which are more familiar. Where there is conflicting testimony, in favor of opposite methods, we must always suppose a variation in the circumstances of the disease and of the treatment. Where the most frequently repeated experiments establish the character of a remedy, we find still a call for attention to its application and management; as in the employment of mercury and venæsection. Even the inestimable value of the vaccine matter, as a preventive of small-pox, though established beyond doubt in a general view, is yet subject to fluctuation, from circumstances which modify its action and defeat its operation. and which prevent our regarding it as a sure specific. Our profession, in its practical capacity. being then not a science, but simply applying the me-

dical sciences (see the author's pamphlet on the Division of Labor in Medical Practice.—Hatchard and Son), we must go on reasoning and inferring, and nicely weighing contingencies, and acting upon general deductions from our multiplied observations, still prepared to find the fading system of to-day give place to the more enlarged and more refined theory of to-morrow; and we may leave to mathematicians the task of determining how far the power of human agency can be made to square exactly with the causes upon which depraved action depend, when diseases and their cures shall be reduced to definite proportions, medicine as an art abolished, and all such matters, not managed by physicians, surgeons, and accoucheurs, but settled by Cocker's Arithmetic!'

After some further reflections on the re-agency of moral causes, Dr. S. goes on to say—'The intellectual faculties and the affections are beings not to be talked of only, but re-agents, which may be made subservient to our purpose, and auxiliaries in our mode of cure. It is with a view to this important and practical end, that we enquire, whether it be ever allowed us to assemble these spirits of the deep, by throwing out the food upon which they feed, and to summon them by pronouncing the spell which they obey? In matters which we know to be under the control of habit, and so much modified by circumstance, shall we not endeavour to discipline and educate the unruly, and to elicit and develope those which are deficient? We cannot, it is true, create a passion; but we can perhaps lay a train for its appearance; we cannot either form a seed, or construct a plant; but we can cultivate the soil from which they spring, and provoke them by arrangements and contrivances of our own. Shall then the physician, who is, par excellence, the creature of real life, who is all things unto all men, the connecting link of all stages of society, the witness of every act, and the repository of every secret—shall he content himself with advising the frantic man to 'be calm,' and directing the hypochondriac to 'keep up his spirits?' Shall he not rather in critical circumstances exercise a temporary power of dictating, and provide 'ne quid damni capiat respublica?' 'De l'ascendant que les ames fortes ont sur les esprits foibles.''

To those who have engaged in the actual practice of the art, the above intimations respecting the peculiar nature of medical researches, and the necessity of something being appended to mere medical science, will be appreciated as indicative of a proper tone of thinking and feeling. With this extract we had intended to close the article; but, as we are called upon to fill up our page, we shall do it by transcribing the concluding sentences of an address, delivered some time since, preliminary to a course of chemical instruction.

'Let the student of medicine,' says the lecturer, 'be given to understand that science will prove nugatory, and learning a vain thing in the practice of physic, if they shall be calculated on as answerable to all the exigencies of morbid circumstance in the way that philosophy teaches planetary motions, or calculates upon phases in the celestial bodies.

'Good sense and independent judgment, and a ready discernment are, in medicine, what taste and correct feeling are to the fine arts—they are the links which bind the several parts of science into one comprehensive and consistent totality—they are that which may keep from the extravagance and mannerism, as artists would say, of a school—they infuse life, and soul, and order, into what, without them, would be a lifeless and confused mass of materials. Let then no opportunity be lost of getting knowledge, but with all your gettings get wisdom; or, in other words, cultivate that disposition of mind which shall at once enable you to learn from others, and judge for yourself, and which shall often direct you what to do, and what to leave undone, where testimony is unavailing and science impotent.

'With respect to your general conduct in society as members of a liberal calling, and as partaking in an especial manner of that responsibility which attaches to every individual in social life, I feel that it is not necessary for me to expatiate at large; but I shall just use the freedom of urging consistency of conduct amidst all the chances and changes of this precarious and oftentimes painful existence. Be on your constant guard against the usurping influence of those malignant passions which belong to our nature. Let the superior success of a rival practitioner, should such happen to be the case, in the district where you reside, be suffered to excite as little as may be the feelings or the manifestations of envy. Conscious of having done your best to deserve success, persevere, in spite of apparent or temporary obstacles, in the manly endeavour to gain success; and calmly leave the event to the disposal of a superior power.

'Let no temptation of temporary advantage impel you to the adoption of a measure, either of a public or private kind, of which, when you ask counsel of your conscience respecting its expediency, the reply of 'the man within the breast' is, Desist; for, when once you lose that self-respect which is only to be retained by a firm resistance to every thing of an equivocal nature, you not only lose with it peace of mind, but the very act of compliance unlocks the door to the more easy access of future errings.

'In the event of large success in your profession, and in the world, let your honors and emoluments be borne meekly. Recollect that your less fortunate rival has the same feelings, and perhaps equal merit with yourself; and that, seeing the most stable reputation in medicine may receive a shock as serious in its nature as it had been unlooked for and unmerited in its occurrence.

'You have much before you of endurance, of forbearance, of enjoyment. You have embraced a profession which is full of uncertainties and anxieties; but, at the same time, rich in high and important truths; pregnant with sources of satisfaction; and abounding with circumstances of delight. And I here reiterate the conviction which I have expressed on former occasions, that in spite of all the uncertainties of the art, and all the vexations its practice involves, it will be found that the qualified, and conscientious, and consistent, practitioners will meet with full cause of self-congratulation, on the score of conscious utility, and full reason for being contented and happy in his course and calling.'

INDEX.

As the numbers are not continued in the last parts of the article, except to mark the diseases, we have indicated some of the particulars pointed out in the following index by the page, and have then placed p. before the number.

MEDI'ETY *n. s.* } Fr. *mediété, mediocrité;*
MEDIOC'RITY, } Lat. *medietas, mediocritas.*
Middle state; between two extremes; moderate degree: moderation; temperance.

When they urge us to extreme opposition against the church of Rome, do they mean we should be drawn unto it only for a time, and afterwards return to a *mediocrity?* *Hooker.*

Men of age seldom drive business home to the full period, but content themselves with a *mediocrity* of success. *Bacon.*

There appeared a sudden and marvellous conversion in the duke's case, from the most exalted to the most depressed, as if his expedition had been capable of no *mediocrities.* *Wotton.*

Great wits have great errors, and great estates have great cares; whereas *mediocrity* of gifts or of estate hath usually but easy inconveniencies. *Bp. Hall.*

They contained no fishy composure, but were made up of man and bird; the human *mediety* variously placed not only above but below. *Browne's Vulgar Errours.*

He likens the *mediocrity* of wit to one of a mean fortune, who manages his store with great parsimony; but who, with fear of running into profuseness, never arrives to the magnificence of living. *Dryden's State of Innocence.*

Getting and improving our knowledge in substances only by experience and history, is all that the weakness of our faculties in this state of *mediocrity*, while we are in this world, can attain to. *Locke.*

MEDINA (Sir John Baptist), an eminent painter, was son of Medina de L'Asturias, a Spanish captain, who had settled at Brussels, where the son was born in 1660. He was instructed by Du Chatel; and afterwards made Rubens his principal model. He was both an historical and portrait painter; and was held in extraordinary esteem by most of the princes of Germany, who distinguished him by several marks of honor. He married young, and came into England in 1686, where he drew portraits for several years with great reputation, as he painted strong resemblances with remarkable freedom of touch, and a delicate management of tint. The earl of Leven encouraged him to go to Scotland, and procured him many engagements. He returned to England for a short time; but went back to Scotland, where he died, and was buried in the Greyfriars church-yard at Edinburgh in 1711, aged fifty-two. He painted most of the Scotch nobility, and the professors of Edinburgh; but was not rich, having twenty children. He was knighted by the duke of Queensberry, being the last knight made in Scotland before the Union.

MEDINA, the capital of Woolly, a kingdom of Western Africa, contains from 800 to 1000 houses, and is defended by a high wall, surrounded by a thick hedge. It stands in long. 12° 50′ W., and lat. 13° 38′ N.

MEDINA, a city of Arabia, next in honor to Mecca for its sacred connexion with the founder of the Mahometan faith. It contains the tomb of the prophet, though the orthodox do not believe the body to be enclosed in it, but to have been transported to heaven. Still this tomb is held in great veneration; but a visit to it is not considered in any very high degree meritorious, and is performed by few. Medina does not consist of more than 500 ill-built houses; and the sacred tomb itself is not superior to those which the founders of mosques usually erect. It is placed between those of the caliphs Abubeker and Omar: the building being hung with silk, which is renewed every seven years. The guard of forty eunuchs, according to Niebuhr, is chiefly designed to keep off the populace, who seek to carry off relics. Here is a very magnificent mosque, founded by the prophet, being supported by 400 columns, and containing 300 lamps, which are kept always burning. Jambo, on the Red Sea, is the port of Medina.

MEDINA DEL CAMPO, the ancient Methymna Campestris, an inland town of the province of Leon, Spain, has been the birth-place and residence of several of her kings. It is of good size, and has a neat square, with a noble fountain. The town is separated by the little river Zapardiel, into two parts. Here is a Jesuits' college, a respectable structure; and a well endowed hospital. This town has three annual fairs. Population between 5000 and 6000. The country around is rich in wine. Thirty-seven miles north-west of Segovia.

MEDINA DEL RIO SECO, an old town of Leon, is situated in a plain, watered by the Sequillo. It contains three parish churches, four convents, three hospitals, and about 8000 inhabitants. Noted in former times for its population, manufactures, and fairs, it received the name of India Chica, or the Little Indies. The castle is now entirely in ruins, and the whole place in a decayed state. Twenty-five miles north-west of Valladolid.

MEDINA SIDONIA is an ancient town of Spain, in Andalusia, having two churches, six monasteries, and about 5000 inhabitants. It has long given the title to a duchy; and the families of Medina Celi and Medina Sidonia are now united. Twenty-two miles south-east of Cadiz.

MEDIOLANUM, in ancient geography, a city of Italy, the capital of the Insubres, built by the Gauls, now called Milan. It was a municipium; a place of great strength; and the seat of the liberal arts; whence it had the name of Novæ Athenæ. See MILAN.

MEDIOLANUM AULERCORUM, an ancient town of Gallia Celtica, afterwards named Eburovicum Civitas (Antonine), corrupted to Civitas Ebroicorum, and this last to Ebroica; whence the modern name Evreux.

MED'ITATE, *v. a.* & *v. n.* } Fr. *mediter*
MEDITA'TION, *n. s.* } Italian *meditare;*
MED'ITATIVE, *adj.* } Span. *mediter;*
Lat. *meditor.* To plan or contrive; to think upon: as a neuter verb, to contemplate; muse; dwell upon with deep thought: the substantive and adjective correspond.

His delight is in the law of the Lord, and in his law doth he *meditate* day and night. *Psalm* i. 2.

Blessed is the man that doth *meditate* good things in wisdom, and that reasoneth of holy things. *Ecclus.* xiv. 20

Them among
Theer set a man of ripe and perfect age,
Who did them *meditate* all his life long.
Faerie Queene

Some affirmed that I *meditated* a war; God knows I did not then think of war. *King Charles.*

In *meditation*, those which begin heavenly thoughts, and prosecute them not, are like those which kindle a fire under green wood, and leave it so soon as it but begins to flame; losing the hope of a good beginning, for want of seconding it with a suitable proceeding. *Bp. Hall.*

Meditate till you make some act of piety upon the occasion of what you *meditate*; either get some new arguments against a sin, or some new encouragements to virtue. *Taylor.*

'Tis most true,
That musing *meditation* most affects
The pensive secresy of desert cell. *Milton.*

To worship God, to study his will, to *meditate* upon him, and to love him; all these bring pleasure and peace. *Tillotson.*

Like a lion that unheeded lay,
Dissembling sleep, and watchful to betray,
With inward rage he *meditates* his prey. *Dryden.*

Thy thoughts to nobler *meditations* give,
And study how to die, not how to live.
Granville.

Some thought and *meditation* are necessary; and a man may possibly be so stupid as not to have God in all his thoughts, or to say in his heart, there is none. *Bentley.*

Before the memory of the flood was lost, men *meditated* the setting up a false religion at Babel. *Forbes.*

MEDITERRANE', *adj.*, MEDITERRA'NEAN, or MEDITERRA'NEOUS. } Fr. *mediterranée*, of Lat. *medius* and *terra*. Encircled with land; inland; remote from the sea.

In all that part that lieth on the north side of the *mediterrane* sea, it is thought not to be the vulgar tongue. *Brerewood.*

It is found in mountains and *mediterraneous* parts; and so it is a fat and unctuous sublimation of the earth. *Browne.*

We have taken a less height of the mountains than is requisite, if we respect the *mediterraneous* mountains, or those that are at a great distance from the sea. *Burnet.*

The MEDITERRANEAN SEA, the Mare Internum of the ancients, extends in length from the strait of Gibraltar to the coast of Syria, nearly 2300 miles; but is of a breadth varying from 300 to 900 miles: the limits of its latitudes are 45° 54′ and 30° 5′. It is united to the Atlantic by the strait of Gibraltar, the Fretum Herculeum, Columnarium, and Gaditanum, of ancient geography, receiving the first two names from the promontories of Abyla and Calpe, the ancient pillars of Hercules; and the latter from Gades (Cadiz). The Arabs gave to the strait the name of Babuz Zukak, the gate of the way. Its length is fourteen leagues, and the breadth where narrowest six leagues.

The Mediterranean has been thought to have been originally a vast lake, the waters of which being suddenly increased by an irruption of the Black Sea, at the time of the formation of the latter, forced themselves a passage through the present strait of Gibraltar, and produced the inundation that submerged the great Atlantic island of Plato: Buffon, however, objects to this hypothesis on the ground that it is the ocean which runs into the Mediterranean, and not the latter into the ocean: he believes that the Mediterranean was in reality a lake, and that the strait was formed by a sudden convulsion produced by some earthquake, or violent effort of the ocean against this spot. This opinion, which was also that of several of the ancients, is supported by the similarity of the strata observed at equal elevations on the opposite sides of the strait.

The Mediterranean forms various *gulfs*, the three most considerable of which are the Gulf of Venice or Adriatic Sea (a name derived from the now small town of Adria, on the Tartara, nine leagues south of Venice, anciently washed by the sea); the Archipelago (Ægean Sea); and the Gulf of Tripoli on the coast of Africa.

Portions of this, the largest expanse of water in the world not denominated an ocean, have also other distinctive names. The space between the Balearic Islands and Spain is by the Spaniards called the Sea of Valencia (Mare Balearicum). That between Sardinia, Corsica, Italy, and Sicily, the ancient Tyrrhenian Sea, is named sometimes the Sea of Tuscany and of Sicily. The great gulf by which the Adriatic is entered is called the Ionian Sea, and the eastern extremity of the Mediterranean from the isle of Candia is denominated the Levant.

Gulfs of this sea, of a secondary description, are those of Lyon (Sinus Gallicus, Sinus Leonis), Genoa (Sinus Ligusticus), and Tarente (Tarentinus). The first extends from Cape St. Sebastian, in Catalonia, to the Isles of Hieres; the Gulf of Genoa, in its most extensive sense, from these islands to the promontory of Piombino; and the Gulf of Tarente is a branch of the Ionian Sea.

The *current* that flows into the Mediterranean from the ocean has been supposed to prove its level to be lower than that of the Atlantic, an effect which can only be produced by the loss of more of its water by evaporation than is restored to it by rivers, rains, &c.: its level is certainly also lower than that of the Red Sea. We are acquainted with but few authentic notices of the depth of the Mediterranean. In the channel between Sicily and Malta the greatest depth is 100 fathoms, while between Malta and Cape Bon there is not more than thirty fathoms water. The inward current is much stronger on the African shore of the strait of Gibraltar, and even at times an outward current is experienced on the opposite coast. From the strait the current sets strongly to the east along the coast of Africa, following its direction to the coast of Syria, where it sets to the north and to the west along the coast of Caramania, at the rate of one mile per hour. The current from the Black Sea passes to the south through all the channels of the Archipelago. A current sets into the Adriatic along the east coast quite to its head, and out on the opposite coast. The general current sets out along the coasts of France and Spain; but with the wind from north-west it is the reverse, the currents then setting in along the coasts of Spain and France; and indeed, throughout the sea, the currents are considerably affected by the winds.

The idea of a submarine current in the strait of Gibraltar rests on the following curious and almost decisive facts:—Dr. Hudson, in a paper communicated to the Philosophical Transactions, above a century ago, says, 'In 1712 M. de L'

Aigle of the Phœnix, off Marseilles, giving chace near Ceuta Point to a Dutch ship, came up with her in the middle of the gut between Tariffa and Tangier, and there gave her one broadside which sunk her. A few days after, the sunk ship, with her cargo of brandy and oil, arose on the shore near Tangier, at least four leagues to the west of the place where she sunk, and directly against the strength of the current; which has persuaded many men that there is a recurrency in the deep water in the middle of the gut that sets outward to the grand ocean, which this accident very much demonstrates.' Philosophical Transactions, vol. xxxiii. p. 192.

Lieutenant (afterwards admiral) Patton, when lieutenant of the Emerald, being overtaken with a very heavy gale of easterly wind, in approaching the rock of Gibraltar, when night came on it became necessary to lay the ship to, under a close-reefed main-topsail, to wait for day-light and better weather; and this was done as nearly as possible in the mid channel. About one o'clock in the morning lieutenant Patton observed an unusual darkness on the lee beam, and supposing it to be land, and the vessel to be in imminent danger, he instantly wore the ship, without waiting even to acquaint the captain. Finding it impossible to clear the land by setting sails, he saw that there was no chance of saving the ship but by trusting to the anchors. One of them was accordingly let go, but before it took effect the vessel struck the ground three times; but the ship, notwithstanding the very high swell, and the breakers within half a cable's length of the stern, rode fast till day-break, when the weather became more moderate, and the vessel was found to have drove in at the back of the rock of Gibraltar, by a counter current. In consequence of this narrow escape, lieutenant Patton was led to study the subject of the currents of the strait of Gibraltar.

'He had ascertained by experience,' says his brother, captain Patton, 'that when two fluids meet in a narrow channel, the one being lighter than the other, that which is heaviest will run out below, at the same rate exactly that the fluid which is lightest runs in above. Of the truth of this any person may satisfy himself by filling two long phials, one with salt water and the other with fresh; color one of them with ink, or any other substance to distinguish it, and place the mouths of the phials close together, holding them horizontally: the salt water, which is heaviest, will be seen to run out below, exactly at the same rate that the fresh water, which is lightest, runs in above. The same law of nature holds with respect to air, which is also a fluid; if, for example, the air in a room is more heated than the air in the outside, or next apartment, it will of consequence become rarified and lighter; if the doors be opened between them, and a lighted candle be placed on the floor of the passage of the door, the flame will blow inward with the cold air running in below; but if the candle is held up, near the upper part of the door, the flame will go outward with the warm and light air, blowing out as fast above as the heavy air comes in below.

'Lieutenant Patton, therefore, very naturally conceived that, if the water within the Mediterranean be heavier than the water in the Atlantic, the water of the latter, according to the laws of gravity and fluids, must of course run in above, and at the some rate the water of the Mediterranean, being heaviest, run out below; and in this particular case, as the cause must be perpetual, the effect must follow; and the upper or surface current never cease to run in from the Atlantic to the Mediterranean. In order to ascertain the fact, whether the water in the Mediterranean is actually heavier than the water in the Atlantic, Lieutenant Patton filled some bottles of sea-water, at a distance from all land, in the Atlantic, and also some bottles near the middle of the Mediterranean, which were afterwards carefully and accurately weighed; when a flask, containing one pound six ounces and five drachms of the Atlantic water, was found to be thirteen grains lighter than the same flask most exactly filled with an equal quantity of the Mediterranean water. The difference of weight seems small in the contents of a flask, but, on so large a body of water as the gut of Gibraltar must contain, is quite sufficient to account for the constant current which, from this cause, as lieutenant Patton has fully ascertained, runs from the Atlantic into the Mediterranean.'

To this testimony may be added the fact lately communicated to Dr. Marcet by Dr. Macmichael, on the authority of the British consul at Valencia, that some years ago a vessel was lost at Ceuta, on the African coast, and its wreck afterwards thrown up at Tariffa on the European shore, full two miles west of Ceuta.

The *tides* of the Mediterranean are all, on the whole, inconsiderable; but they have, in some places, a perceptible rise and fall. The greatest seems to be at Venice, where the extreme difference is three feet. At Marsala, in Sicily, the flood comes from the north-east, and the rise is two and a half to three feet; at Naples one foot, at Toulon one to two feet, on the coast of Syria only six inches. The winds also produce partial and irregular elevations of water, which in many instances have probably been mistaken for tides: when strong westerly winds blow, for any continuance, they force an accumulated body of waters through the strait, which raises the general level of the sea, while strong Levant winds have a contrary effect; nevertheless it is observed that, in the sea of Tuscany, south-east winds cause a greater elevation of the tide; on the north coast of Sicily, particularly at Marsala, where, as we have observed, the common rise is but three feet, with a strong south-east wind it is as much as ten or eleven. In the strait of Euripus, which separates Negropont from the continent, a singular phenomenon occurs: during the first eight days of the moon, as well as from the fourteenth to the twentieth day, and for the last three days, the tide ebbs and flows regularly four times in the twenty-four hours; while, during each of the other days it ebbs and flows with great force from eleven to fourteen times, though the difference of elevation never exceeds two feet. Aristotle is said to have drowned himself here from a feeling of humiliation at being unable to account for this.

In the strait of Messina is found the celebrated Charybdis, which at present is not considered a very dangerous agitation of the waters. It occupies a space of about 100 feet in circumference opposite a little cove east of Faro light-house called Calo Faro, and about 250 yards from the shore. The agitation only takes place when the current is ebbing, or setting through the strait from the north, when its stream makes with the shore a number of angles of incidence which retard its progress, so that it takes two hours to reach Charybdis from the entrance of the strait. Here it produces a considerable rippling, but no vortex; for the light substances thrown into it, instead of being carried down, are tossed about on the surface. The depth of water here is about eighty fathoms. Between the tides there is a period of repose, of never more than an hour nor less than a quarter of an hour. When the wind blows strongly from the south against the current, the waves rise to a dangerous height for open boats; but the only danger to a large vessel is of being driven on shore by the stream, her sails and rudder being in this spot useless. In order to prevent such accidents, expert seamen, with proper boats, are kept constantly ready on the beach, at Messina, to put off to the assistance of any vessel. On the Calabrian shore, opposite Charybdis, is the equally celebrated rock of Scylla, a little promontory the extremity of which is 200 feet in perpendicular height. At low water many rocks show themselves at its base; and these, with the currents and waves rushing with great fury and noise into the neighbouring caverns, doubtless gave rise to the poetical fiction of 'the dogs howling round the monster Scylla.' However this rock is not without a certain degree of danger, which in some measure authorises the proverb of 'falling upon Scylla in trying to avoid Charybdis;' for the tide setting directly on it, and the depth being too great for anchorage, a ship is liable to be driven on it in either a calm or a contrary wind. On the summit of the promontory is a castle, and on the south side a little village.

The *Fata Morgana* of the strait of Messina is to the ignorant as wonderful a phenomenon as was Scylla or Charybdis to the ancients. 'In fine summer days,' says a late French traveller, 'when the weather is calm, there rises a vapor from the sea which, when it has acquired a certain density, forms, in the atmosphere horizontal prisms, whose sides are so disposed that they reflect for some time like mirrors the objects on the coast, exhibiting by turns the city of Messina, trees, animals, men, mountains, &c. This representation continues for eight or ten minutes, when shining irregularities are observed on the surface of the prisms, that first render confused the objects they reflect and the picture dies away gradually.'

The Mediterranean being the receptacle of but four rivers of magnitude, while a stream from the Atlantic continually runs into it, its waters are as saline as those of the latter. According, indeed, to the late experiments of Dr. Manet they are even more so. The singularity of this has been explained upon the supposition that the Mediterranean is not supplied, by the rivers which flow into it, with a quantity of fresh water sufficient to replace what it loses by evaporation under a burning sun, aided by a powerful radiation from the African shores and the parching winds blowing from the adjacent deserts: and philosophers suppose that the only reason why this sea does not gradually increase in saltness, and become converted into saturated brine, is the under current of water already mentioned, salter than the ocean, which runs out at the strait of Gibraltar, and unloads its waters of their excess of salt.

This sea has several springs of fresh water rushing up from amidst the salt, the most celebrated of which is in the grand port of Tarento, called the Little Sea, and at some distance from the mouth of the Galesus: it is in such force and abundance that it may be taken up without the least mixture of salt water.

The *winds* most prevalent in the Mediterranean blow between north-west and north-east, with few intermissions, for nine months of the year, and almost constantly during summer. In the other three months (February, March, and April) south-east and south-west winds prevail. The nature and effects of the winds in the Mediterranean, however, differ greatly according to locality. On the south of Spain the Solano wind (called in Italy the Sirocco) is from the south-east. These, blowing from the sandy deserts of Africa, bring with them, particularly to Sicily and Naples, a degree of insupportable heat. During their continuance the elasticity of the air seems to be lost, and both the body and mind are reduced to debility. At Palermo, where the intensity of the Sirocco is greatest, it never lasts more than forty-eight hours, but at Naples it sometimes continues for weeks. The Mistral is a north-west wind which blows with great violence down the Gulf of Lyon. The Kamsin a S. S. W. wind, which blows in Egypt in March and April, generally not more than three successive days at a time. While it continues, the atmosphere seems to be on fire, and acquires a purple tinge; and the transient blasts which succeed from time to time, resemble the breath from a furnace. This is the period in Egypt when the plague, which seems to be indigenous in this country, bursts forth in all its violence. The Kamsin signifies the wind of fifty days, thus named because it only happens, it is said, during fifty days of March and April. The Samiel, or poisonous wind of the Arabs, which at Bassora blows from north-west, at Bagdad from west, at Mecca from the east, and in Syria from the south-east, and which is also the Simoom of the desert, is similar in its nature and effects. It contains a great portion of azote.

Towards the east of the Mediterranean the temperature of the atmosphere varies more with the wind than in any other part of the world. In the Archipelago the northern winds, Tramontana, the Etesian winds of the ancients (though this denomination was also extended to all periodical winds), which blow at times with great violence during summer, bring a considerable degree of cold, and obscure the horizon in a remarkable manner. They are very injurious to vegetation, and cause violent head-aches. A few

hours of these winds cover the mountains of Epirus with snow, which as speedily disappears with a few hours of the Sirocco. On the coasts of the Levant there are land and sea breezes; the latter, on the coasts of Turkey, is called the Imbat. In some places the former are exceedingly baneful, particularly in the island of Candia, where they are said frequently to suffocate those exposed to them.

The Marobia is a northern phenomenon of this sort, most probably deriving its name from Mare Ubbriaco, or drunken sea, as its movement is apparently very inconsistent. It occurs principally on the southern coast of Sicily, and is generally found to happen in calm weather, but is considered as the certain precursor of a gale. The Marobia is felt with the greatest violence at Mazzara, perhaps from the contour of the coast. Its approach is announced by a stillness in the atmosphere and a lurid sky; when suddenly the water rises nearly two feet above its usual level, and rushes into the creeks with amazing rapidity; but in a few minutes recedes again with equal velocity, disturbing the mud, tearing up the sea-weed, and occasioning noisome effluvia: during its continuance the fish float quite helpless on the turbid surface, and are easily taken. These rapid changes (as capricious in their nature as those of the Euripus) generally continue from thirty minutes to upwards of two hours; and are succeeded by a breeze from the southward, which quickly increases to heavy gusts.—*Smyth's Memoir of Sicily*.

The *temperature* of the Mediterranean varies greatly, according to peculiar circumstances. Towards the south the climate approaches to that of the tropics, while on the north the variations of the seasons are more considerable. The greatest severity of winter, however, does not exceed some days of light frost, and the snow never lies more than a few hours in the valleys of the coasts. The Adriatic being frozen, in the years 860 and 1234, is recorded as a singular phenomenon. In the eastern part of the sea, and particularly amongst the islands of the Archipelago, the winters are disagreeable, from the prevalence of the Sirocco, accompanied by heavy storms of rain, thunder, and lightning. The climate of Attica, on the contrary, is constantly dry and serene. The medium heat of the sea around Sicily, at a depth of from ten to twenty fathoms, by Six's thermometers, is from 73° to 76°, which, being 10° or 12° warmer than the water outside Gibraltar, accounts for the greater evaporation and consequent currents.—*Smyth's Memoir*, p. 184.

Coral is the most important af the *marine productions* of the Mediterranean. It is found in great abundance round the Lipari Islands, in the strait of Messina, and on the coast of Barbary; but the French and Sicilians are the only nations who make its fishery an object of industry. The former, on the coast of Barbary, is said to produce a profit of 360,000 francs per annum. That of the Sicilians, round Lipari and Volcano, employs about sixteen boats; and that in the strait of Messina eighteen to twenty, with eight men in each. The produce is about 3000 lbs. weight per annum. The spots on which this substance is found, in the strait, are nearly in the middle, from the Faro to opposite the church of the Grotto, on the Sicilian shore, an extent of six miles; and on two small rocky spots opposite the canal of St. Stephen, eight miles south of Messina. The depth here is from sixty to ninety fathoms. This space is divided into ten portions, one of which only is fished every year, so that each has ten years rest, the time found necessary to allow the coral to grow. To the extremities of a wooden cross pieces of net are fastened; the machine is sunk by heavy weights, and dragged over the bottom, breaking off the branches of coral which thus get entangled. A trifling quantity of this substance is also fished in the gulf of Ajaccio (Corsica), and in some spots near Sardinia and Minorca. Eleven other species of the gorgona, or sea fan, are found in this sea.

It also possesses a great variety of naked mollusca, amongst which the medusa pulmo is the most common in the seas of Italy. The holuthuria phasalis (Portuguese man of war of our seamen) is also common in this sea, and is named by the French la vellette and la galere, the sail and the galley. The species of testaceous mollusca are also very numerous: the murex afforded the celebrated purple dye of the ancients. Oysters, limpits, scollops, and muscles, are abundant; and of the latter is a singular species, found in the gulf of Nice and the Adriatic, enclosed in masses of limestone at the bottom of the sea. It is called, from its resemblance to that fruit, the sea date (pholas dactylus) and much esteemed by the epicures of Rome and Naples. The lanna pinna, or sea pine, is a bivalve, which affords a kind of tow, or silk, that is manufactured into gloves, stockings, &c. These fish are taken principally round Cape St. Vito, the south point of the Gulf of Taranto. The paper nautilus is also met with, but rarely.

The common lobster and crab abound on the coast of Tuscany; and the squilla arenaria is a very delicate prawn, of the Adriatic. Ichthyologists reckon thirty-eight genera of fish, divided into upwards of 100 species, in the Mediterranean and its tributary rivers.

But the indolence of most of the modern races who inhabit its coasts prevents the fisheries of this sea from being carried to any extent as an object of commerce; and with the exception of the tunny fish, anchovies, and sprats, the whole produce is consumed. The tunny enters the Mediterranean in shoals from the ocean in spring, and passes through into the Black Sea and Sea of Azoph, in whose shoal waters it is supposed to spawn: they return to the ocean in autumn. 'It is said,' observes Mr. Tuckey, 'that these fish enter the Black Sea along the coast of Asia and return along that of Europe; Aristotle and Pliny, who noticed this fact, account for it by supposing the fish to see better with the right eye than with the left. It is however more natural to suppose that the prevailing winds are the cause; for when the fish enter the channel they are chiefly from the south, and, when they return, from the north; the fish therefore prefer the smooth water under the weather shore. These fish are also said to spawn in the Italian seas.

The French carry the tunny fishery to the greatest extent. These fish arrive on the coast of Provence from June to September inclusive, and are taken both with hook and line and with nets.'

'The thonaire, used here, is a number of nets joined together and hauled on shore like the seine, when the shoals of fish appear, for whose arrival a strict watch is kept by persons placed on the hills. The madrague is an enclosure of nets, consisting of several apartments, like a succession of rooms opening one into the other, the nets which compose them being kept in a perpendicular position by floats and weights. The outer apartment, called the hall, has an opening through which the fish enter, and when it is full the opening is closed by another piece of net, let down by the fishermen who attend in the boat. The fish are then frightened by the noise of the men into the second apartment, and so on to the others, there being from four to eight, until they get into the last, which is called the chamber of death, and when this is full the nets that form it are raised to bring the fish to the surface, when they are killed with spears and harpoons.'

This fishery is also carried on on the coast of Valencia, from April to September, with nets in the same manner, called almadrabas, and on the coast of Sardinia, the fisheries of which produce upwards of £70,000 a year. The Sicilians carry on this fishery near the isles of Maretimo, &c.; and the Neapolitans in the gulf of Taranto. The female fish are much the largest, weighing from 800 lb. to 1200 lb. The method of curing is by cutting off the head and dividing the fish into six or eight pieces: it is then either simply salted, or is boiled and preserved in oil. The belly pieces are preferred for this last purpose, and the fish thus prepared is called by the French thon marine, and by the Italians tarantilla, from its being prepared chiefly at Taranto: the livers and roes are also salted.

The anchovy enters this sea in shoals in May, June, and July, and is an important object of the French fishery. The preparation consists in cutting off the head, which is said to be bitter, emptying the inside, and salting and packing in little barrels. The most esteemed are those taken near Gorgona; but the people of Frejus are considered the most expert in curing them. The French, Valencians, and Italians, also take great quantities of sprats on their coasts, which they both smoke and salt. The season of this last fishery is from December to March.

The sword-fish is taken in the gulfs of Genoa and Messina. The fishery commences on the Calabrian shore in April, and lasts till July, when it begins on the opposite coast of Sicily and lasts till August. The fish enter the gulf from the north close along the Calabrian shore, and in their return from the south keep close to the Sicilian shore. Twenty to thirty feluccas, and a number of smaller boats are employed in this fishery with harpoons, or it is carried on with nets called palmidores.

The fish chiefly taken in the gulf of Lepanto are mullet, which are dried in the sun for the consumption of the Greeks during their fasts, and the roes made into boutaraga, a kind of inferior caviar, which is exported to France and Italy. The preparation of this object consists in highly salting the roes, pressing them between boards, and then washing and drying them in the sun, or smoking. The mackarel is a visitor of the Mediterranean; and some writers have given the herring to this sea, but the fish called harengade and celerin, on the coast of France, is now ascertained to be only a large sprat. The red turmulet abounds on the coast of Egypt, particularly in winter; the raia aquila is also chiefly met on this coast: the barbel is likewise to be found on the lakes of Naples.

The hippocampus, or cavallo marino of the Italians, abounds in the gulf of Naples and the Adriatic, where it is washed up dead on the shores, and when dried is preserved as a curiosity, the head having a resemblance to that of the horse, and the tail to that of the shrimp. The Italian women take it to increase their milk, and use it externally as an anodyne to the breast: it has also been used with honey and vinegar in hydrophobia. The gadus minutus arrives periodically, and is followed by numbers of large fish, to the great joy of the fishermen, who make them their food.

Instances have occurred of great cetaceous animals being taken in the Mediterranean, but they are considered only as individuals which have strayed thither. A pike-headed whale, 100 feet long, was taken in 1620 near the island of Corsica; and in 1790 a round-nosed whale was killed on the coast of Provence. The whale which Pliny mentions as having entered the port of Ostia, in Claudius's reign, clearly excited the attention of the Roman populace by its being considered a wonder. But this sea habitually yields the grampus (delphinus orca), the delphinus feres, the common porpoise (delphinus phocæna), and the bottle-nosed porpoise (delphinus delphis) the dolphin of naturalists. The modern Greeks are said to have a great veneration for this latter.

Here are of amphibious animals, of the genus phoca, three species—the common seal (phoca vitulina), the hooded seal (phoca monachus), and the little seal (phoca pusilla). They frequent the desert isles, particularly of the Ionian Sea and the Archipelago: the Zantiots are the only people that take them for their skins and fat. Two species of sea turtle are also met with in the Mediterranean—the loggerhead and hawksbill: the sea birds are, various species of the gull and diver, the storm-petrel, tern, sea swallow, and wild duck.

We have room but to add an extract from an ingenious paper of Dr. Robertson's adddressed to Dr. Brewster, in the Edinburgh Philosophical Journal, 1819, on the luminous appearance of the waters of this sea: a specimen of which is seen in the Fata Morgana, already alluded to.

'In addition to these observations,' says this writer, 'I beg leave to offer what I have remarked respecting the very luminous appearance of its waters on the slightest agitation, so frequently perceived after sunset, especially during the warm season. By many people this has been supposed to be caused by certain minute luminous insects existing in the water, to the disengagement of phosphorus from the excrements, or

remains of fishes that have died, and other putrid matters. By seamen this luminous appearance, from the slightest agitation, has been considered as generally the precursor of blowing weather, and I am persuaded, from repeated observation, that the remark is as correct as it is general.

'This luminous appearance is but rarely met with during the winter season, compared to the frequency with which it occurs in the summer and autumn. I have never seen it when the wind blows fresh from a northerly point, or when the temperature of the air is low; nor have I remarked it in any great degree but in calm weather, when the temperature of the air was high, and especially as the wind was changing towards a southerly point, and I have always observed that this luminous matter was emitted most strongly immediately preceding the fall of rain or an overcasting of the sky, showing a disposition to the formation of that meteor. Upon the whole I am of opinion that this appearance of light, on the agitation of the waters of the Mediterranean, is somehow or other connected with evaporation, and that it is occasioned by the rapid evolution of the electric fluid in that process; that probably it rarely depends on phosphoric matters existing in the waters; and, after repeated and careful observations by myself and others, I have never been able to trace its appearance as depending on the existence of insects, nor could I ever perceive any thing peculiar in the sensible qualities of water taken up in such circumstances, or that was different from the water of the sea when it did not give out this luminous appearance.'

ME'DIUM, *n. s.* Lat. *medium.* A mean; any thing interposing or intervening; hence the middle term, or step, of an argument; middle place or degree.

Whether any other liquors, being made *mediums*, cause a diversity of sound from water, it may be tried. *Bacon.*

All the old philosophy consented that virtue and vice had no *medium* between them, but whatsoever was not evil was good. *Bp. Taylor.*

He who looks upon the soul through its outward actions often sees it through a deceitful *medium*, which is apt to discolour the object. *Addison.*

The parts of bodies on which their colours depend are denser than the *medium* which pervades their interstices. *Newton.*

To find the *medium* asks some share of wit,
And therefore 'tis a mark fools never hit.
Cowper.

Medium, in philosophy, that space or region through which a body in motion passess to any point: thus ether is supposed to be the medium through which the heavenly bodies move (see Ether); air the medium wherein bodies move near our earth; water the medium wherein fishes live and move; and glass is also a medium of light, as it affords it a free passage.

Medium, Arithmetical, or arithmetical mean, or medium rei; that which is equally distant from each extreme, or which exceeds the less extreme as much as it is exceeded by the greater, in respect of quantity, not of proportion; thus nine is a medium betwixt six and twelve.

Medium, Circulating. Upon this prolific topic we expected (see our article Bank) to see the public mind and the procedures of the monied interest in a far different state to that in which we find them, at the date of drawing up this article. While of the issues of the Bank of England an account is periodically afforded, of the banking system (if such there be), in this the highest and most influential quarter, no intelligible account is allowed to circulate beyond the court of directors; and even to the proprietors no statement of profits is afforded. We have only therefore to add to that article that the bank of England has returned to cash payments, and, having been allowed to plant branch banks at the distance of not less than sixty miles from London, has made the experiment with considerable success in several large towns; that this year (1829) the country banks have withdrawn all their small notes from circulation, with little or no apparent difficulty to themselves; but that the result on the manufactures and mercantile interests is far from being fully ascertained. For the manner in which the various mercantile towns abroad conduct their banking measures we must refer to what we have been able to collect respecting them in the several separate articles. Some hints on the connexion of the doctrine of Currency with that of our Corn Laws may be found in the article Corn Laws. From a writer there quoted we may add the following extract as worthy the consideration of all classes:—

'Equity demands, in favor of the landed proprietor, an equivalent for the exclusive charges fixed by law on his estate: that equivalent must be a protecting duty on foreign corn imported; the amount of the duty is a fit subject for discussion: but here we are arrested by the past variations in the value of our currency, and the price which we have first to settle is the price of money; for it is impossible to establish a fixed protecting duty with fairness, when the standard of value is itself unfair. This appears to me the very core of the whole subject, the point on which you have committed the most fatal errors. You have fought for high prices, and concurred in measures which render them impossible. You have retained your monopoly, but consented to a change in the value of money which must destroy its efficacy. The ground which you still endeavour to defend is no longer tenable; and the points which you have surrendered ensure your defeat. If I might venture to allude to the conduct of the landed interest in the last session of parliament (1825–1826), I should say, that it affords conclusive evidence of the blindest adherence to the single object of high prices, coupled with an entire misapprehension of the means by which this object might be attained, and of the general principles on which the prices must depend; the price of commodities, and of corn among the rest, is compounded of two ingredients—of the supply in the market compared with the demand, and also of the value of money; itself the measure of value, liable, however, to great variation, in proportion to its quantity.

'The value of money is the inverse ratio of

its quantity; the supply of commodities remaining the same. Increase the quantity of money, prices rise: decrease the quantity of money, prices fall. On the other hand, the quantity of money remaining the same, increase the quantity of commodities, prices fall: decrease the quantity of commodities, prices rise. Thus a decrease of the quantity of money produces the same effect on the price of a commodity as an increase of the quantity of the commodity itself; if corn be that commodity, an addition to the value of money, such as the diminution of its quantity occasions, ensures as effectually a fall in the price of corn as the opening of the ports and free importation: in which of the two cases prices would fall lowest is a simple question of proportion between the increased supply of corn and the decreased quantity of money. These truths are elementary, and admitted as axioms; yet the conduct of the landed interest proceeds on a virtual denial of their validity. The high price of corn being their declared object, they direct their whole strength to the preservation of their monopoly of the supply, and at the same time contribute their support to measures designed to diminish the quantity of money and to increase its value. Their whole attention is absorbed by one half of the object of price—they look only to the supply, they disregard the measure of value.'

Medium, Geometrical, or medium personæ, is that where the same ratio is preserved between the first and second as between the second and third terms; or that which exceeds in the same ratio or quota of itself, as it is exceeded: thus six is a geometrical medium between four and nine.

MED'LAR, *n. s.* Sax. mæꝺ, from its being used in mead. The Mespilus of Linné, which see.

You'll be rotten ere you be half ripe
And that's the right virtue of the *medlar*.
Shakspeare.

October is drawn in a garment of yellow and carnation; with a basket of services, *medlars*, and chesnuts. *Peacham.*

Men have gathered from the hawthorn's branch
Large *medlars*, imitating regal crowns. *Philips.*

The leaves of the *medlar* are either whole, and shaped like those of the laurel, as in the manured sorts; or laciniated as in the wild sorts. *Miller.*

MED'LE, Med'ly, *v. a.* & *n. s.* Med'ley, *n. s.* & *adj.* } Goth. *medal*; Swed. *medel*, mingled. To mingle or mix (obsolete as a verb): a mixture; miscellany; confused mass or congeries: medley is used by Dryden for mingled; confused.

Ther is nothing that savoureth so sote to a child as the milke of his norice, ne nothing is to him more abominable than that milke whan it is *medled* with other mete. *Chaucer. Personnes Tale.*

Some imagined that the powder in the armory had taken fire; others, that troops of horsemen approached: in which *medly* of conceits they bare down one upon another, and jostled many into the tower ditch. *Hayward.*

I'm strangely discomposed;
Qualms at my heart, convulsions in my nerves,
Within my little world make *medley* war.
Dryden.

Mahomet began to knock down his fellow-citizens, and to fill all Arabia with an unnatural *medley* of religion and bloodshed. *Addison.*

They count their toilsome marches, long fatigues,
Unusual fastings, and will bear no more
This *medley* of philosophy and war. *Id. Cato.*

MEDMANN, or Mettmann, a town in the Prussian states of the Rhine, in the duchy of Berg, having manufactures of cotton, woollen, and hardware. Population 4000. Six miles E. N. E. of Dusseldorf.

MEDUL'LAR, *adj.* Medul'lary. } Fr. *medullaire*; from Lat. *medulla*, pith. Pertaining to the marrow.

The back, for the security of that *medullary* substance that runs down its cavity, is bent after the manner of the catenarian curve. *Cheyne.*

These little emissaries, united together at the cortical part of the brain, make the *medullar* part, being a bundle of very small, thread-like channels or fibres. *Id.*

MEDUSA, in mythology, one of the three Gorgons, and the only one subject to mortality. She was celebrated for her personal charms, and the beauty of her locks. Neptune became enamoured of her, and obtained her favors in the temple of Minerva. This profanation provoked Minerva, who changed the beautiful locks of Medusa into serpents, the sight of which turned the beholders into stones: but Perseus, armed with Mercury's axe, cut off Medusa's head, from whose blood sprang Pegasus and Chrysaor, together with the innumerable serpents that infest Africa. He placed Medusa's head on the ægis of Minerva, which he had used in his expedition; and the head still retained its petrifying powers.

Medusa, in zoology, a genus of vermes, belonging to the order of mollusca. The body is gelatinous, roundish, and depressed; and the mouth is in the centre of the under part of the body. Many species, on being handled, affect with a nettle-like burning, and excite a redness. They were named by the Greeks πνευμα θαλασσιος, and by the Romans pulmo marinus, or sea lungs. They attributed medicinal virtues to them. Dioscorides says that, if rubbed fresh on the diseased part, they cured the gout in the feet, and kibed heels. Ælian adds that they were depilatory; and, if macerated in vinegar, would take away the beard. Their phosphoric quality is well known; nor was it overlooked by the ancients. Pliny observes that if rubbed with a stick it will appear to burn, and the wood to shine all over.

Medusa Capillata, the capillated medusa, is a very singular animal; it is easily broken and destroyed by a touch; its shape is rounded, rising into a convexity in the middle, where it is therefore thickest; on the under side it is plain, and on this there is visible a rough, or, as it were, an echinated circle, within which there run eight pairs of rays from the centre toward the circumference; from the centre there arise also a number of curled appendages. This species is met with in vast abundance, floating on the surface of the water about Sheppey Island in Kent and elsewhere on that coast. This species is called by many authors pulmo marinus, or the sea lungs

MEDUSA LUMINOSA, a species discovered by Sir Joseph Banks, to which he has given the name of luminosa, as, when brought aboard by the casting net, it had the appearance of metal violently heated, and emitted a white light. These luminous animals are one of the causes of that appearance of the sea which has been mentioned by many navigators, and for which various reasons have been assigned. They seemed to emit flashes of light exactly resembling those of lightning, only not so considerable; but so frequent, that sometimes eight or ten were visible at the same moment.

MEDUSA UNDULATA, the waved medusa, has the edges waved, with fangs on the projecting parts; four orifices beneath, between which rises a stem divided into eight large ragged tentacula. These animals swim in large companies in search of food, with their tentacula in continual motion, with which they seize their prey, and convey it to their mouths; they vary in size, the largest being generally about eight inches in diameter. They vary likewise in the number of their tentacula; some have only two; others four, six, and some eight, but they rarely exceed that number. So powerful is their embrace, that whatever prey comes within their reach never escapes. They subsist on insects, small fish, &c.

MEDWAY, a river of England, which rises in the Weald of Sussex, and, entering Kent near Ashurst, runs by Tunbridge, and thence continues its course towards Maidstone. It is navigable for large ships to Rochester Bridge, and thence for vessels and barges to Maidstone, the tide flowing up to that town. The distance between its mouth, where the fort at Sheerness is erected, and Rochester Bridge, is between sixteen and eighteen miles. In this part of the river, the channel is so deep, the banks so soft, and the reaches so short, that it is one of the best and safest harbours in the world; and ships of eighty guns ride a-float at low water, within musket-shot of Rochester Bridge. Nor is there an instance upon record, that any of the royal navy ever suffered here by storms, except in the dreadful tempest in November 1703, when the Royal Catharine was driven on shore, sunk, and lost. On the banks are two castles, one at Upnor, to defend the ships between that and the bridge; the other is Gillingham Castle, well furnished with cannon, which commands the river. There is also a platform of guns at a place called the Swam, and another at Cockham Wood. But the principal fort is at Sheerness.

MEED, *n. s.* Sax. meꝺ; Teut. *meeten, myde*; Goth. *met*. Reward; hence present; gift; recompense, good or evil.

But if I do this thing wilfulli I haue *meide*? but if aghens my wille dispendyng is bitaken to me.
Wiclif. 1 *Cor*. ix.

Ne for prayer, ne for *mede* he wil not be corrupt.
Chaucer. Personnes Tale.

He knows his *meed*, if he be spide,
To be a thousand deaths, and shame beside.
Spenser.

Whether in beauties glory did exceed,
A rosy garland was the victor's *meede*.
Faerie Queene.

Thanks to men
Of noble minds is honourable *meed*. *Shakspeare.*

Plutus, the god of gold,
Is but his steward; no *meed* but he repays
Seven-fold above itself. *Id. Timon of Athens*

He must not float upon his watery bier
Unwept, and welter to the parching wind,
Without the *meed* of some melodious tear.
Milton.

A long and prosperous enjoyment in the land of Canaan was the *meed* set before them, if they should obey and make good their part of the covenant.
Barrow.

If so, a cloak and vesture be my *meed*,
Till his return no title shall I plead.
Pope's Odyssey.

MEEK, *adj.*
MEEK'EN, *v. a.*
MEEK'LY, *adv.*
MEEK'NESS, *n. s.*
Goth. and Swed. *mink*; Danish, *mygr*; Hebrew, מך. Mild or pliable of temper; 'not easily provoked:' to meeken is to soften: meekness, gentleness; mildness; suavity.

Moses was very *meek* above all men.
Numb. xii. 3.

Hir *meke* praiere and hir pitous chere
Made the markis for to han pitee.
Chaucer. Cant. Tales.

Be therefore, O my dear lords, pacifyed,
And this mis-seeming discord *meekly* lay aside.
Faerie Queene.

That pride and *meekness* mixt by equal part,
Do both appear to adorn her beauty's grace.
Spenser.

You sign your place and calling, in full seeming,
With *meekness* and humility; but your heart
Is crammed with arrogancy, spleen, and pride.
Shakspeare.

Both confessed
Humbly their faults, and pardon begged, with tears
Watering the ground, and with their sighs the air
Frequenting, sent from hearts contrite, in sign
Of sorrow unfeigned, and humiliation *meek*.
Milton.

No pride does with your rising honours grow
You *meekly* look on suppliant crowds below.
Stepney.

We ought to be very cautious and *meek*-spirited, till we are assured of the honesty of our ancestors.
Collier.

When his distemper attacked him, he submitted to it with great *meekness* and resignation, as became a Christian. *Atterbury.*

The glaring lion saw, his horrid heart
Was *meekened*, and he joined his sullen joy.
Thomson.

If thou art rich, then shew the greatness of thy fortune, or, what is better, the greatness of thy soul, in the *meekness* of thy conversation; condescend to men of low estate, support the distressed, and patronize the neglected. *Sterne.*

MEER, or
MERE, *n. s.*
MEERED, *adj.*
Sax. mepe; Belg. *meer*. A lake or river: hence a boundary: meered is bounded, or relating to a boundary.

What, although you fled! why should he follow you?
The itch of his affection should not then
Have nickt his captainship; at such a point,
When half to half the world opposed, he being
The *meered* question.
Shakspeare. Antony and Cleopatra.

MEEREN, or MEER (John Vander), an esteemed painter, born in 1627. He chose for his subjects sea-pieces, landscapes, and views of the

sea and its shores; which he painted with great truth, as he had accustomed himself to sketch every scene after nature. He also painted battles with approbation. He died in 1690.

MEEREN, or MEER (John Vander) the Young, an eminent landscape-painter, supposed to have been the son of the preceding, of whom he learned the rudiments of the art; but, being deprived of his instructor before he had made great progress, he became a disciple of Nicholas Bergham, and was accounted the best of those who were educated by that admired master. In the style of his master he painted landscapes and cottages, with peasants at their rural occupations and diversions; but he very rarely introduced cows, horses, or any other animals, except goats and sheep, which last are highly finished. His touch is scarcely perceptible, and yet the colors are admirably united. He died in 1688. His genuine works bear a very high price, and are esteemed even in Italy.

MEERJAOW, a town of the province of Canara, Hindostan, on an inlet of the sea. It is supposed to have been the Musiris of the ancients; and was nearly destroyed by Hyder Aly when he invaded the province in 1773. The neighbouring forests abound with teak and black pepper. Long. 74° 36′ E., lat. 14° 27′ N.

MEERMAN (Gerard), a Belgic writer on jurisprudence, was born at Leyden in 1722; and was an author at the age of seventeen. Between 1744 and 1748 he was abroad in several voyages; and, on his return, was appointed pensionary counsellor of Rotterdam. In 1766 he was made counsellor of the high tribunal of the chace of Holland and West Friseland; and died at Aix-la-Chapelle, December 15th, 1771. The emperor created him a baron of the German empire; and Louis XV. invested him with the order of St. Michael. He possessed an immense collection of books and MSS.; and presented several of the latter to the French king's library. Among his works may be specified Novus Thesaurus Juris civilis et canonici, 1751—54, 7 vols. folio; and Origines Typographicæ, 1765, 4to.

MEERMAN (John), son of the preceding, was born in 1753, and early distinguished for learning. He studied at Leipsic under Ernesti; and completed his education at Leyden, where, in 1774, he took the degree of LL.D. He now visited France, Italy, Germany, Great Britain, and Ireland; and, on his return home, he was elected burgomaster of Leyden, a situation which he soon resigned. Under Louis Buonaparte he was director of the fine arts and of public instruction in Holland; and, on the union of that country to France, he was made a count of the empire. He died August 19th, 1815, leaving to the city of the Hague the rich library of his father, which he had largely increased. His best known published works, including a supplementary volume to his father's Thesaurus, are the History of William, earl of Holland, and king of the Romans, 5 vols. 8vo.; The Relations of Great Britain and Ireland, of Austria, of Prussia, and of Sicily, 1787—94, 5 vols. 8vo.; The Relations of the North and North-West of Europe, 1905-6, 6 vols. 8vo.; containing observations made by the author in his travels.

MEERSCHAUM, in mineralogy, a kind of clayey earth, the keffekil of Kirwan. Color yellowish and grayish-white. Massive. Dull. Fracture fine earthy. Fragments angular. Opaque. Streak slightly shining. Very soft, sectile, but rather difficultly frangible. Adheres strongly to the tongue. Feels rather greasy. Specific gravity 1·2 to 1·6. Before the blowpipe it melts on the edges into a white enamel. Its constituents are, according to the analysis of Klaproth, silica 41·5, magnesia 18·25, lime 0·50, water and carbonic acid 39. It occurs in the veins in the serpentine of Cornwall. When first dug, it is soft, greasy, and lathers like soap. Hence the Tartars use it for washing clothes. In Turkey it is made into tobacco-pipes, from meerschaum dug in Natolia, and near Thebes. See *Jameson's Mineralogy* for an entertaining account of the manufacture.

MEET, *adj.* } Sax. mæte; Goth. *mæti*, in
MEET'LY, *adv.* } measure. See METE. Fit; proper; adapted; suitable. 'Meet with' is a low phrase for 'even with' you.

> Arcite is ridden anon unto the toun,
> And on the morwe, or it were day light,
> Ful prively two harneis hath he dight,
> Both suffisant and *mete* to darreine
> The battaille. *Chaucer. Cant. Tales.*

Ah! my dear love, why do you sleep thus long, When *meeter* were that you should now awake? *Spenser.*

If the election of the minister should be committed to every parish, would they choose the *meetest*? *Whitgift.*

> I am a tainted wether of the flock,
> *Meetest* for death.
> *Shakspeare. Merchant of Venice.*

> To be known shortens my laid intent,
> My boon I make it, that you know me not,
> Till time and I think *meet*. *Id. King Lear.*

Niece, you tax Signior Benedick too much; but he'll be *meet with* you. *Shakspeare.*

As for the comfort of conjugal society, what other did our good God intend in the making of that *meet* helper? *Bp. Hall.*

The eye is very proper and *meet* for seeing. *Bentley.*

MEET, *v. a.* & *n. s.* } Sax. metan; Belg.
MEET'ER, *n. s.* } *moetan*; Teut. *moten*;
MEET'ING, } Goth. & Swed. *mota.*
MEETING-HOUSE, *n. s.* } To encounter; come face to face: hence to oppose in conflict or hostility; close with; join; to find; light upon; accost: as a neuter verb, to assemble; congregate: it frequently takes the preposition *with* after it. A meeting is an encounter; assembly interview, or place of assembly or meeting Meeting-house, an old but well-fashioned word signifying a dissenting place of worship.

His daughter came out to *meet* him with timbrels and dances. *Judges* xi. 34.

They appointed a day to *meet* in together. 2 *Maccabees.*

When he cometh to experience of service abroad, he maketh as worthy a soldier as any nation he *meeteth with.* *Spenser.*

> When shall we three *meet* again,
> In thunder, lightning, or in rain?
> *Shakspeare. Macbeth.*

Falstaff at that oak shall *meet with* us. *Shakspeare.*

There are beside
Lascivious *meeters*, to whose venomed sound
The open ear of youth doth always listen. *Id.*

Let's be revenged on him; let's appoint him a *meeting*, and lead him on with a fine baited delay. *Id.*

Met'st thou my posts? *Id.*

We *meet with* many things worthy of observation. *Bacon.*

Before I proceed farther, it is good to *meet with* an objection, which if not removed, the conclusion of experience from the time past to the present will not be found. *Id.*

A little sum you mourn, while most have *met*
With twice the loss, and by as vile a cheat. *Creech.*

Mean while our primitive great sire, to *meet*
His godlike guest, walks forth. *Milton.*

To *meet* the noise
Of his almighty engine, he shall hear
Infernal thunder. *Id.*

Their choice nobility and flower
Met from all parts to solemnize this feast. *Id.*

The materials of that building happily *met* together, and very fortunately ranged themselves into that delicate order, that it must be a very great chance that parts them. *Tillotson.*

I knew not till I *met*
My friends, at Ceres' now deserted seat. *Dryden.*

Not look back to see,
When what we love we ne'er must *meet* again. *Id.*

Had I a hundred mouths, a hundred tongues,
I could not half those horrid crimes repeat,
Nor half the punishments those crimes have *met.* *Id.*

If the fathers and husbands of those, whose relief this your *meeting* intends, were of the household of faith, then their relicks and children ought not to be strangers to the good that is done in it, if they want it. *Sprat's Sermons.*

He yields himself to the man of business with reluctancy, but offers himself to the visits of a friend with facility, and all the *meeting* readiness of desire. *South.*

Royal mistress,
Prepare to *meet with* more than brutal fury
From the fierce prince. *Rowe's Ambitious Stepmother.*

Our *meeting* hearts
Consented soon, and marriage made us one. *Rowe.*

The nearer you come to the end of the lake, the mountains on each side grow higher, till at last they *meet.* *Addison.*

What a majesty and force does one *meet with* in these short inscriptions: are not you amazed to see so much history gathered into so small a compass? *Id. on ancient Medals.*

Hercules' *meeting with* pleasure and virtue, was invented by Prodicus, who lived before Socrates. *Addison.*

His heart misgave him that the churches were so many *meetinghouses;* but I soon made him easy. *Id.*

To me no greater joy,
Than that your labours *meet* a prosperous end. *Granville.*

Of vice or virtue whether blest or curst,
Which *meets* contempt, or which compassion first. *Pope.*

Since the ladies have been left out of all *meetings*, except parties at play, our conversation hath degenerated. *Swift.*

Meg fain wad to the barn gane
To win three wechts o' naething;
But for to *meet* the deil her lane,
She pat but little faith in. *Burns.*

MEGALE POLIS, written dividedly by Ptolemy and Pausanias; or conjunctly Megalopolis, according to Strabo; an ancient town of Arcadia, built under the auspices of Epaminondas, after the battle of Leuctra; many inconsiderable towns being joined together in one great city (whence the name), the better to withstand the Spartans. Strabo says it was the greatest city of Arcadia. It was destroyed by Cleomenes III., king of Sparta.

MEGALESIA, AND MEGALENSES LUDI, feasts and games in honor of Cybele or Rhea, the mother of the gods, held on the 12th of April by the Romans, and famous for great rejoicings and diversions of various sorts. The Galli carried the image of the goddess along the city, with drums and other music, in imitation of the noise made to prevent Saturn from hearing the cries of his infant son Jupiter, when he was disposed to devour him.

MEGANTICK, a lake of Lower Canada, on the borders of New England, from which the river Chaudiere in part arises. It is nine miles in length, and two in average breadth, running deeply into the land. It is surrounded by some excellent meadows, and altogether the scenery is beautifully picturesque here: large groups of stately trees ranging above each other until they crest the summit of the rising lands. The waters abound with fish; and the country is the resort of almost every species of game.

MEGARA, in ancient geography, a noble city, capital of Megaris, which for many years carried on war with the Corinthians and Athenians. It had for some time a school of philosophers, called the Megarici, successors of Euclid the Socratic, a native of Megara. Their dialect was the Doric; changed from the Attic, which it formerly had been, because of the Peleponnesian colonists who settled there. Megara was situated at a distance from the sea. Its port was called Nisæa, from Nisus, son of Pandion II., who obtained Megaris for his portion, when the kingdom of Athens was divided into four lots by his father. He founded the town, which was eighteen stadia, or two miles and a quarter from the city, but united with it, as the Piræus with Athens, by long walls. It had a temple of Ceres. The site is now covered with rubbish, among which are standing some ruinous churches. The place has been named from them Dode Ecclesiais, the Twelve Churches; but the number is reduced to seven. The acropolis or citadel, called also Nisæa, was on a rock by the seaside. Some pieces of the wall remain, and a modern fortress has been erected on it, and on a less rock near it. Megara consists now only of a few cottages on the slope of an eminence, divided in the middle.

A few inscriptions are found, with pedestals fixed in the walls and inverted; and also some mutilated statues. One of the former relates to Atticus Herodes, and is on a pedestal which supported a statue erected to him when consul, A. D. 143, by the council and people of Me-

gara, in return for his benefactions to the city. In the plain behind the summits is a large basin of water, with scattered fragments of marble, the remains of a bath or fountain, which is recorded as in the city, and remarkable for its size and ornaments, and for the number of its columns. The spring was named from the local nymphs called Sithnides. The stone of Megara was of a kind not found any where else in Hellas; very white, uncommonly soft, and consisting of cockle shells. This was chiefly used, and, not being durable, may be reckoned among the causes of the desolation at Megara, which is so complete that one searches in vain for vestiges of the many public edifices, temples, and sepulchres, which once adorned the city. Megara was engaged in various wars with Athens and Corinth, and experienced many vicissitudes of fortune. It was the only one of the Greek cities which did not flourish under their common benefactor Adrian. Another benefactor was Diogenes, son of Archelaus, who bestowed on the Megarensians 100 pieces of gold towards building their towers, and also 150 more, with 2200 feet of marble, towards re-edifying the bath. This Diogenes was one of the generals employed by the emperor Anastasius on a rebellion in Isauria, and took the capital Claudiopolis, A. D. 494.

MEGARIS, in ancient geography, the country of the Megareans, is described as a rough region, like Attica; the mountain called Oneian, or the Asinine, now Macriplayi, or the Long Mountain, extending through it towards Bœotia and Mount Cithæron. It belonged to Ionica or Attica, until it was taken by the Peloponnesians in the reign of Codrus, when a colony of Dorians settled in it. This territory had Attica on the east, Bœotia on the north and west, and the Isthmus of Corinth on the south.

MEGASTHENES, a Greek historian in the age of Seleucus Nicator, about A. A. C. 300. He wrote concerning the oriental nations, and particularly the Indians. His history is often quoted by the ancients. What now passes as his composition is spurious.

MEGIDDO, in ancient geography, a town of Galilee, mentioned (Josh. xvii. 11) among the cities of Manasseh, in the tribe of Issachar or Asser, on the west side of the Jordan, near an open plain, fit for drawing up an army in battle array. It was situated on the north, contrary to its position in the common maps. The Canaanites, being tributary to the Israelites, dwelt in it, Josh. xvii. It was rebuilt by Solomon, 1 Kings ix; and is remarkable for the deaths of Ahaziah king of Israel, and Josiah king of Judah, 2 Kings ix. 27; xxiii. 29.

MEGNA, THE, a river of Hindostan, formed by the junction of numerous streams, which issue from the mountains on the northern boundary of Bengal. The principal of these is the Brahmapootra. Below Dacca it is joined by the Issamutty, Dullasary, Luckia, and Ganges, after which it pours its immense waters into the bay of Bengal, forming several large islands at its mouth. Between these the tide enters with great rapidity, forming in the spring tides what is called the Bore, and which in a few minutes rises twelve feet high. The sand-banks run nearly thirty miles into the sea. This appears to be the proper entrance of the Ganges.

ME'GRIM, *n. s.* Fr. *migraine*; Gr. ημικρανια. Disorder of the head.

In every *megrim* or vertigo there is an obtenebration joined with a semblance of turning round.
Bacon's Natural History.

There, screened in shades from day's detested glare,
Spleen sighs for ever on her pensive bed,
Pain at her side, and *Megrim* at her head. *Pope.*

MEHALLET KEBEER, a city of Lower Egypt, the capital of the district of El Garbie, in the Delta, and standing on a canal between the eastern and western branches of the Nile. It is of considerable magnitude and commercial importance, so as to be called Kebeer 'the great,' and possesses manufactures of cloth and sal ammoniac. Long. 31° 24′ E., lat. 30° 50′ N.

MEHKOOR, a populous district of Hindostan, in the province of Berar; situated between two ranges of mountains, and subject to the Nagpore rajah.

MEHWAS, a district of the province of Gujerat, Hindostan, situated on the south-east bank of the Puddar. The inhabitants, formerly Hindoos, have been converted in considerable numbers to the Mahometan religion, and are marauders, who live by plunder. Any one who can head twenty horsemen considers himself an independent chief. They breed horses and cattle, but cultivate little of the soil.

MEIBOMIUS (John Henry), a learned German, who was professor of physic at Helmstadt, where he was born, and at Lubec. He wrote the Life of Mæcenas, published at Leyden, in 4to. 1653, with several other learned works.

MEIBOMIUS (Henry), son of the preceding, was born at Lubec in 1638; he became professor of physic at Helmstadt; and, besides medical works, published Scriptores rerum Germanicorum, 3 vols. folio, 1688; a very useful collection, first begun by his father.

MEIBOMIUS (Marcus), another writer of the same family, who published a collection of seven Greek authors, who had written upon ancient music, with a Latin version by himself, dedicated to queen Christina of Sweden, who invited him to her court. But his enthusiasm in favor of ancient music subjected him to a degree of raillery, that made him leave the court of Sweden. His edition of the Greek mythologists, and notes upon Diogenes Laertius in Menage's edition, show him to have been a man of learning.

MEJERDAH, a river of Tunis, the Bagrada of the ancients, in the western part of that territory, and running along the borders of Algiers, till it falls into the Mediterranean at Porto Farina. The country beside its banks is level, and very rich, in consequence of which it is deeply impregnated with soil, and often presents the same discolored aspect as the Nile. It is one of the most considerable streams in Barbary.

MEINUNGEN, a principality of Saxony forming part of the duchy of Saxe-Meinungen, and divided into the Oberland and the Unterland, two districts situated at some distance from each other. The extent of the whole is

about 448 square miles. The Unterland is the larger of the two, containing nearly 350 square miles, and a population of 40,000. It is traversed by the Werra, and has extensive forests, several iron mines, and mines of coal and cobalt. The manufactures, which are not considerable, are of woollen, linen, and hardware. The chief export is salt from the mines of Salzungen. The Oberland has 16,000 inhabitants, and is a hilly district of the great forest of Thuringia.

Meinungen, a town of the above principality, situated amongst mountains, on the Werra. Since 1681 it has been the residence of the dukes of Saxe-Meinungen, who have an elegant palace here, with a library and a depôt of archives. Here is also a lyceum, council-house, and state-house. The chief manufacture is black crape. Population 4200. Twenty-one miles north of Schweinfurt.

MEINY, n. s. Sax. menigu; old Fr. *mesnie, mesne; Lat. mansio*. A house or family; a retinue or train.

They summoned up their *meiny*; strait took horse;
Commanding me to follow, and attend. *Shakspeare.*

MEISSEN, or Misnia, a circle of Saxony, on both sides of the Elbe, and extending from Bohemia on the south, to Prussian Saxony on the north. Part of it was ceded to Prussia at the congress of Vienna in 1815, but it has still an area of 1600 square miles. It is one of the best cultivated parts of Saxony, and yields corn, fruit, flax, hops, and pasturage, in abundance, and, in a few districts, wine. It contains also the principal manufactures of the kingdom in woollen, linen, and cotton. Dresden itself lies within its limits. Inhabitants 298,000.

Meissen, a town of Saxony, the capital of the former margraviate and circle of this name, is situated on the left bank of the Elbe, at its junction with the Meissa, in one of the most beautiful valleys of Saxony. It is divided into three parts: the upper and middle towns, and the suburbs. On a rock, eighty feet in height, stand the remains of an ancient castle, built by the emperor Henry I.; and on a neighbouring eminence the rock of Afra, the ancient monastery of that name. The objects worth notice in this town are the fine Gothic cathedral, the chapter-house, and a covered bridge over the Elbe. This place is also distinguished for its porcelain manufacture, the clay of which is yielded in the neighbourhood. Population 4000. Fifteen miles W. N. W. of Dresden.

MEISSNER (Augustus Theophilus), an author of German romances, was the son of a Saxon quarter-master, and born in 1753 at Bautzen in Lusatia. He studied law and the belles lettres at Leipsic and Wittemberg, and became keeper of the archives at Dresden. His literary career commenced in his translating comic operas from the French. In 1785 he obtained at Prague the chair of belles lettres, and twenty years after was invited to Fulda, to direct the superior schools. He died in 1807. Meissner translated Hume's England into German, 1777-1780, and wrote a number of historical romances and other works. His Sketches have been translated into French, Danish, and Dutch.

MEKRAN, a large maritime province of Persia, extending along the shore of the Indian Ocean to Scinde, and on the west and north to Kerman and Seistan. It has been little traversed by travellers. Alexander the Great, in returning from his Indian expedition, passed through this province, and the sufferings and hardships endured by his army gave the most unfavorable impression of the nature of the country. The northern and inland part is the Baloochistan of modern geography, and separated from the maritime part by a range of mountains. See Baloochistan. The entire province is occupied by a great number of independent chiefs, whose power and territory is always fluctuating. The whole military force of the country may amount to about 25,000 men. Around Bunpore the people are migratory, and live in tents of black hair. The women of Mekran are not confined as in other Mussulman countries. The chief place at present is Kei.

MEL, honey. See Honey.

MELA (Pomponius), an ancient Latin writer, who was born in Hispania Bætica, and flourished under Claudius. His three books of Cosmography, or De Situ Orbis, are written in a concise, perspicuous, and elegant manner. Isaac Vossius gave an edition of them in 1658, 4to., with copious notes.

MELADA, Meleda, or Melit, an island of the Austrian empire, on the coast of Dalmatia. It formerly belonged to the republic of Ragusa, and has a town of the same name; a good harbour, and a large monastery. Population 2000. Long. of the eastern point 17° 58' E., lat. 43° 5' N.

Melada, a small barren island of Dalmatia, at the entrance of the canal of Zara, to the north of Isola Grossa. It is inhabited chiefly by fishermen.

MELALEUCA, in botany, the cayputi, or cajeput-tree, a genus of the polyandria order, and polydelphia class of plants: cal. quinquepartite, superior: cor. pentapetalous; the filaments are very numerous, and collected in such a manner as to form five pencils; there is one style: caps. half-covered with the calyx, formed like a berry, trivalved and trilocular. The species are all natives of India and the South Sea Islands. The most remarkable is,

M. leucodendron, from a variety of which (the latifolia, or broad-leaved leucodendron) the cajeput oil is obtained: a medicine in very high esteem among the eastern nations, particularly in India. It is said to be obtained by distillation from the fruit. When brought into this country it is a liquid of a greenish color, of a fragrant but very peculiar odor, and of a warm pungent taste. Hitherto the oleum cajeput has been little employed either in Britain or on the continent but in India it is used both internally and externally, and is highly extolled for its medical properties. It is applied externally where a warm and peculiar stimulus is requisite; it is employed for restoring vigor after luxations and sprains.

MELAMPODIUM, in botany, a genus of the polygamia necessaria order, and syngenesia class of plants; natural order forty-ninth, com-

positæ; receptacle palæaceous and conical; pappus monophyllous and valve-like; CAL. pentaphyllous.

MELAMPUS, in fabulous history, a celebrated soothsayer and physician of Argos, son of Amythaon and Idomenea or Dorippe. He lived at Pylos in Peloponnesus. His servants once killed two large serpents who had made their nests at the bottom of a large oak; and Melampus paid so much regard to their remains, that he raised a funeral pile and burned them upon it. He also took their young ones, and fed them with milk. Some time after this, the young serpents crept to Melampus, as he slept on the grass near the oak; and, as if sensible of the favors of their benefactor, they wantonly played around him, and softly licked his ears. This awoke Melampus, who was astonished at the sudden change which his senses had undergone. He found himself acquainted with the chirping of the birds, and all their rude notes, as they flew around him. He took advantage of this supernatural gift; made himself perfect in the knowledge of futurity, and Apollo instructed him in the art of medicine. He soon after cured the daughters of Prœtus, by giving them hellebore, which from that circumstance has been called melampodium; and, as a reward, he received the eldest princess in marriage. The tyranny of his uncle Neleus, king of Pylos, obliged him to leave his native country; and Prœtus gave him part of his kingdom. About this time the personal charms of Pero, the daughter of Neleus, had gained many admirers; but the father promised his daughter to him only who should bring him the oxen of Iphiclus. Bias, who was one of her admirers, engaged his brother Melampus to steal the oxen. Melampus was caught in the attempt and imprisoned; and nothing but his services as a soothsayer and physician could have saved him from death. But when he had taught the childless Iphiclus how to become a father, he not only obtained his liberty, but also the oxen; and with them he compelled Neleus to give Pero in marriage to Bias. A severe distemper, which had rendered the women of Argos insane, was totally removed by Melampus; and Anaxagoras, the king, rewarded his merit by giving him part of his kingdom, where he established himself, and where his posterity reigned during six generations. He received divine honors after death.

MELAMPYRUM, cow-wheat, a genus of the angiospermia order, and didynamia class of plants; natural order fortieth, personatæ: CAL. quadrifid: COR. upper lip compressed, with the edges folded back: CAPS. bilocular and oblique, opening at one side; there are two gibbous seeds. There are four species, all natives of Britain, and growing spontaneously in corn fields. They are excellent food for cattle; and Linnæus tells us that, where they abound, the yellowest and best butter is made. Their seeds, when mixed with bread, give it a dusky color, and produce vertigo.

MELANCHOL'Y, *n. s.* & *adj.* } Fr. *melan-*
MELANCHOL'IC. } *colič*; Latin *melancholia*, of Gr. μελαν black, and χολη bile. A disease formerly supposed to proceed from an abundance of black bile, a species of madness; gloomy; pensive; hypochondriac temper.

He protested that he had only been to seek solitary places by an extreme *melancholy* that had possessed him. *Sidney.*

I have neither the scholar's *melancholy*, which is emulation; nor the musician's, which is fantastical; nor the courtier's, which is proud; nor the soldier's, which is ambitious; nor the lawyer's, which is politick; nor the lady's which is nice; nor the lover's, which is all these; but it is a *melancholy* of mine own, compounded of many simples, extracted from many objects, and indeed the sundry contemplation of my travels, in which my often rumination wraps me in a most humorous sadness. *Shakspeare.*

How now, sweet Frank; art thou *melancholy*? *Id.*

It is a false slander raised on Christianity, that it maketh men dumpish and *melancholic*. *Bp. Hall.*

All these gifts come from him; and, if we murmur here, we may at the next *melancholy* be troubled that God did not make us angels. *Taylor's Holy Living.*

Think of all our miseries
But as some *melancholy* dream which has awaked us
To the renewing of our joys. *Denham.*

The king found himself at the head of his army, after so many accidents and *melancholick* perplexities. *Clarendon.*

Moonstruck madness, moping *melancholy*. *Milton.*

This *melancholy* flatters, but unmans you;
What is it else but penury of soul,
A lazy frost, a numbness of the mind? *Dryden.*

If he be mad, or angry, or *melancholick*, or sprightly, he will paint whatsoever is proportionable to any one. *Id.*

He observes Lamech more *melancholy* than usual, and imagines it to be from a suspicion he has of his wife Adah, whom he loved. *Locke.*

The commentators on old Ari-
Stotle, 'tis urged, in judgment vary:
They to their own conceits have brought
The image of his general thought:
Just as the *melancholick* eye
Sees fleets and armies in the sky. *Prior.*

In those deep solitudes and awful cells,
Where heavenly pensive contemplation dwells,
And ever musing *melancholy* reigns. *Pope.*

This sudden view of my danger strikes me with *melancholy*; and, as 'tis usual for that passion above all others to indulge itself, I cannot forbear feeding my despair with all those desponding reflections which the present subject furnishes me with in such abundance. *Hume on the Human Understanding.*

MELANCTHON (Philip), the celebrated contemporary and fellow-laborer of Martin Luther, was born at Bretten, in the Lower Palatinate of the Rhine, in Saxony, on the 16th of February, 1497. His mother was the daughter of John Reuter, for many years mayor of that town, and his father, George Schwartzerd, a native of Heidelburg, who had settled at Bretten in consequence of his marriage, and filled the office of engineer, or commissary of artillery under the palatinate princes Philip and Rupert. In compliance with a custom very prevalent at that time among the learned, our reformer's name was afterwards changed, by his friend Reuchlin or Capnio, from Schwartzerd, signifying black earth, to Melancthon, a Greek appellation of similar import. The conduct of his early studies devolved chiefly on his maternal grandfather

Reuter, who was well qualified for the task, and affectionately solicitous for his improvement. He was first placed at a public school in his native town; but, a contagious disorder having found its way into this seminary, he was withdrawn, and pursued his studies under private tuition. In the Latin language he had for his preceptor John Hungarus of Pforzheim, a scholar of considerable merit, who was delighted with the proficiency of his pupil. At Pforzheim he likewise entered on the study of Greek, which he diligently and successfully cultivated. Happening to lodge at the house of a relation who was sister to John Reuchlin, that elegant scholar was struck with the early proofs of his genius, and presented him with a Greek grammar and a Greek and Latin lexicon. At the age of thirteen he had made so great a proficiency as to write several poetical pieces, and, among others, a comedy, which he dedicated to his friend Capnio, who, on that occasion, gave him the name that he ever afterwards bore.

From Pforzheim, where he resided nearly two years, Melancthon proceeded to the university of Heidelburg, then celebrated for its eminent professors in the different branches of learning; and here he soon so much distinguished himself as to be selected to write many of the public discourses of the professors and others: his credit for learning indeed was so great, that count Leonstein committed to his care the education of his two sons. At this early age he composed his Rudiments of the Greek Language. At Heidelburg he formed an acquaintance with various learned men, particularly the celebrated Pallas, who was for many years the brightest ornament of the academy: but he continued here not more than three years; the place not being thought favorable to his constitution, which was naturally feeble. This circumstance, together with the mortification of being refused a higher degree in the university merely on account of his youth, induced him to remove to Tubingen, a town in the duchy of Wurtemberg. He now attended particularly to the mathematics, jurisprudence, logic, medicine, and theology.

Melancthon was not yet seventeen when, in the year 1513, he took his degree of M. A., and commenced a course of private teaching. Not long after he became a public lecturer in the university on the learned languages, logic, ethics, mathematics, and divinity. His elegant classical taste was the theme of universal admiration, and it was at this period he commenced the restoration of Terence, whose works he arranged in their present poetical form out of the confused prose into which they had been reduced through the ignorance of transcribers. The attention of the learned was now universally attracted to him; and Erasmus declared that he was destined to eclipse himself. The venerable Latimer, too, we find speaking of him in the highest terms, and recommending him strongly to the patronage of king Edward VI.

After residing six years at Tubingen our young reformer removed (25th August 1518), on the invitation of the elector of Saxony, to the university of Wittemberg. So great was the esteem in which he was held at Tubingen, that Simler says, 'The whole city lamented his departure. No one can conceive or estimate how much the academy lost of distinction and emolument when he left.' At Wittemberg his station as Greek professor first brought him into contact with Luther, whom he had the honor of instructing in that language, and who ever readily acknowledged his literary superiority. His public lectures are said sometimes to have been attended by 1500 persons. On his first arrival he found the university in a wretched condition, both as to literature and philosophy; a single copy of the most celebrated Greek classics could not be found in print; and the students were obliged to write out passages as they were explained to them. Melancthon set himself diligently to diffuse the knowledge of this important language. In his first year he delivered lectures on Homer, and on the Greek of the epistle to Titus; all the principal theologians attended him, and all classes were inspired with the love of Greek. His ardor and diligence were indeed too great for his health, and we find the elector Frederick urging him to take wine for the support of his weak frame, and offering him the best in his own cellars. He announced, in an oration delivered in the month of October, a plan for reforming the studies of youth. In this address he particularly urges the study of the Greek philosophy, and the sacred scriptures, promising his pupils every aid that his own industry or erudition could afford. Melancthon was fully aware of the erroneous subtleties of the Aristotelian philosophy, and of the mischievous support which it had so long afforded to false and unscriptural tenets, by involving every subject in metaphysical obscurity; but he possessed a mind which could discriminate accurately, and he therefore carefully availed himself of the general prejudice in its favor, for the illustration and support of real philosophy and religion. With this view he composed a number of elementary treatises, which were, for a long time, in general use in the Lutheran schools, among which may be particularly noticed his Logic; Physics; Ethics; and a Treatise on the Soul: which were applauded by the most competent judges of the age as much calculated to aid the labors of the young student.

Melancthon was present at the celebrated dispute between Carlostadt and Eckius at Leipsic, in the summer of 1519; and, though he represents himself as a mere hearer on this occasion, he became so much interested in the procedings, and so often offered suggestions to Carlostadt, that Eckius was induced to exclaim, with some warmth, 'Tace tu Philippe, ac tua studia cura, nec me perturba.' He afterwards wrote an account of this conference in a letter to a friend, which, falling into the hands of Eckius, produced from him a bitter rejoinder, which Melancthon answered in a small tract, written with so much acuteness, elegance, and candor, that it greatly promoted the cause of the reformers.

In the year 1520 he married Catharine Crappin, the daughter of a burgomaster of Wittemberg, with whom he lived in the most perfect harmony for thirty-seven years, and by whom he had two sons and two daughters. Both the for-

mer died young; the latter were married, the elder to George Sabinus, the younger to Caspar Peucer, an excellent man, who suffered much for maintaining the doctrines of the Reformation.—Melancthon's wife is said to have been a pattern to her sex for the simplicity and purity of her manners, and diligent domestic economy. Yet so great was their hospitality that their house was scarcely ever free from guests, and it seems to have been a maxim with them never to refuse a needy applicant. In addition to these serious deductions, as they may be justly accounted, from his very moderate income, the time of this great man was often severely taxed by the calls of persons soliciting his advice in their difficulties, his correction of literary productions, or his recommendations to others. For a considerable time he delivered his lectures on the Holy Scriptures without any salary; and, when the elector offered to settle on him a pension of 200 florins, he refused it, on the ground that he was unable to devote sufficient time and attention to the duty which he judged was incumbent upon him. When the elector Maurice urged him on this subject, and entreated him at least to ask some favor, he requested his dismission. He is said to have been materially assisted in his projects of benevolence by the faithful care of an affectionate domestic, to whom all the duties of provisioning his family were intrusted, and who, after faithfully discharging those duties and contributing to feed the streams of his charity for more than thirty years, died in the bosom of the family, regretted as a friend. The benevolence of Melancthon, however, was retired, and entirely devoid of ostentation; and, although mentioned by few writers, yet it is an undoubted fact that, when his purse was insufficient to answer the calls that were thus made on it, he would sometimes supply the deficiency by privately disposing of articles of domestic furniture.

Whatever he read or heard he quickly made his own; it is even asserted that he could retain, for the most part, the very words of the writer or speaker. In the midst of all these excellencies he was so modest that he never uttered his opinion without the most serious deliberation, and was ready to acknowledge any mistakes, into which he might have fallen, with the greatest simplicity. His good qualities, indeed, were so conspicuous, that the very enemies of that Reformation, of which he was so ardent a supporter, most readily acknowledged and extolled them.

The importance of so able a coadjutor in the good cause was very apparent, and none valued his assistance more than Luther. During his temporary confinement in the castle of Wartenburg, we find him thus expressing himself: 'The accounts which I receive of your abundant success in religion and learning during my absence rejoice my heart exceedingly, and very much diminish the miseries of separation. The circumstance of your going on so prosperously is peculiarly delightful to me, because it may serve to convince the wicked one, that, however he may rage and foam, his desires shall perish, and Christ will finish the work which he has begun.' While, however, Melancthon was so important an auxiliary to Luther in the great cause in which they were embarked, such was his constitutional timidity, that all the firmness of Luther was necessary to console and support him. Yet we never find him for a moment abandoning the post of duty. In the year 1521 the doctors of the Sorbonne attacked the Lutheran doctrines, in a violent pamphlet; to which Melancthon replied in a piece entitled Adversus Furiosum Parisiensium Theologastrorum Decretum pro Luthero Apologia. In this publication, he, with the keenest satire, exposes the folly of these monkish divines, showing that those very men who contended against Luther for opposing the fathers, were themselves the most diametrically opposed to them. He published another piece this same year against Thomas Placentinus, or Emset, who had attacked Luther on the ground of his secession from the church. A piece which excited the greatest attention, however, at this time, was that which he published under the title of Loci Communes Theologici. It was translated and extensively read in France and Italy, particularly in Venice, till a monk, who had seen it in its German dress denounced it to the inquisitors, and had it suppressed. The author in this publication gives a summary of Christian doctrine, which is at once both lucid and Scriptural, and calculated to make any one, according to Luther, who has become master of it, in conjunction with a thorough knowledge of the Scriptures, a divine against whom neither the devil nor any heretic can be able to stand. In this eventful year also Melancthon was called to take a conspicuous part in the abolition of private masses. The Augustinian Friars at Wittemburg had attempted this in Luther's absence, and the elector, alarmed at the measure, had sent one of his counsellors to remonstrate with them. Our reformer was chosen, in conjunction with five others, to enquire into this matter, and so thoroughly were they convinced of the propriety of the step, that they urged the prince to enforce it throughout his dominions. Melancthon gave full proof in this discussion of his deep acquaintance with the Scriptures and the history of the purer ages of the church, as well as of the firmness with which he could resist corruption; until the elector was finally induced to wink at these innovations, though he did not publicly countenance them.

In the early part of the year 1522 the subject of this memoir was engaged in a conference with Stubner and others of the Anabaptists, see that article. The piety of some of these sectaries and the sufferings they had endured on account of their opinions, made a considerable impression upon his mind, and led him to treat them with more kindness than was shown to them by Luther. The latter indeed readily perceived the dangerous issue of their more prominent opinions.

It has been already mentioned that Melancthon was one of his coadjutors in the translation of the Holy Scriptures (see article Luther), and not a little of the correctness and fidelity with which this work was executed is to be attributed to his labors. His extensive acquaintance with the original languages eminently fitted him for

this work, and no one could feel more than he did its importance to the cause of the reformation. We find him also employed about this time in writing a valuable Commentary on the Epistle of Paul to the Romans, which was not, however, published till the year 1540. In the dedication to Philip of Hesse will be found a clear statement of the author's sentiments on the most important articles of Christian doctrine, as well as a consistent view of the whole train of the apostle's reasoning, while his criticisms are most valuable. In the month of May 1525 he assisted at the funeral of the lamented Frederick, elector of Saxony, and delivered an oration, which affords a high but not unmerited encomium on that prince, the greatest of all the human supporters of the reformed religion of this period.

So highly was Melancthon esteemed at this time, even by the enemies of the Reformation, that not a few attempts were made by the catholic party to draw him over to themselves. That of the celebrated Erasmus is the most remarkable, both because it equally illustrates the dishonest adherence of that eminently learned man to a cause, the weakness and wickedness of which he often exposed in his works, and the steady adherence of our reformer to those opinions which upon the full conviction of his conscience he had adopted. Erasmus used every effort to shake him, by hinting to him the wishes of some of the highest dignitaries in the church that Melancthon would come over to them, and his regret that he had not devoted his great powers to literature alone. The language of Melancthon in reply to these insinuations is decided and noble: 'For my own part,' says he, 'I cannot with a safe conscience condemn the sentiments of Luther, however I may be charged with folly or superstition, that does not weigh with me. But I would oppose them strenuously, if the Scriptures were on the other side; most certainly I shall never change my sentiments from a regard to human authority, or from the dread of disgrace.' We are also told that cardinal Campeggio used his most strenuous endeavours to bring over Melancthon to the orthodox party; but he met with no better success.

It was in consequence of an accidental meeting between our reformer, while on a journey, and Philip the landgrave of Hesse, that the latter first made those enquiries into the nature of the Reformed doctrine which resulted in his adopting it. In the mean time the cause of religion and learning continued to advance in Saxony, and in the latter part of the year 1525, by the permission of the elector, Melancthon repaired to Nuremberg to arrange for the senate the plan of an academical institution there. On the occasion of its opening we find him delivering an oration, in which he complains in very severe terms of the neglect of learning, which marked the priesthood of the day, and animates the senate to proceed in the good work in which they had engaged, as the most seasonable remedy for that evil. So great was the admiration of him excited at Nuremberg, that he was invited to fill a professor's chair in the new university; this, however, he was too warmly attached to Wittemburg to accept: but he continued to correspond with those who had the management of its affairs; and that even at a time when his numerous engagements were seriously injurious to his health.

In the year 1526, when it was judged advisable by the elector of Saxony to present a memorial at the diet of Spires, Melancthon was required by that prince to draw it up, which he accomplished in a very satisfactory manner; refuting the chief objections of the papists to the reformed doctrine; and citing in particular the commandments of Christ and the examples contained in the Scriptures to demonstrate that justification by faith is the great truth of the word of God, which must be maintained at the risk of the severest persecution. He enters upon several other topics with equal faithfulness and power, insisting that the reformers had separated from the Romish church not from the love of schism, but because they were impelled to that separation by the obedience due to the Scriptures and to God. The result of this appeal was highly advantageous, as will be seen in the article Reformation. In the mean time our reformer was called upon to advise the landgrave of Hesse as to the promotion of the Reformation in his states, and in preparing for publication a directory of doctrine and practice. In this work the papists alledged that Melancthon advocated different sentiments to those of Luther, and loudly exulted in the circumstance; nothing, however, was more unfounded, and Luther himself treated the charge with the utmost contempt. A more serious vexation occurred to the author in the conduct of one of his fellow-laborers. In speaking of the law Melancthon had urged the inculcating a spirit of contrition in order to obtain the remission of sins; at this John Agricola was so offended, that a breach took place between him and Melancthon, which was with difficulty made up by the interference of the elector. Agricola afterwards became the founder of a sect called the Antinomians; see Agricola and Antinomians.

Melancthon attended at the second diet of Spires in the year 1529, and was during the meeting the means of preserving the liberty, if not the life, of Simon Grynæus, professor of Greek in the university of Heidelburg. The latter had engaged in an argument with Faber, bishop of Vienna, which induced that crafty prelate to adopt means for removing him by force from the diet. While Grynæus was at supper with his friends, Melancthon, who was of the party, was called out to speak with an old man of singular appearance, who advised that Grynæus should be sent to a place of safety, as some messengers from the king, at the instigation of Faber, were coming to seize him. Grynæus was accordingly sent away, and almost immediately after the messenger arrived: the old man being never afterwards seen or heard of, the warning given was regarded as nothing less than a divine interposition. Melancthon was, during the sitting of this diet, harassed with great anxiety; the interdiction of every innovation in religion, and the solemn protest of the reformed princes, which then took place, made it a scene of great interest; and he and Luther were constantly looked up to

as advisers in these trying circumstances. At the same time the agitation of the sacramental controversy caused them no small grief, especially as it tended to separate them from those whom they could not but regard as brethren. In this year Melancthon published a Commentary on the Epistle to the Colossians, to which Luther wrote a preface, speaking highly of it and preferring it to his own works.

In 1530 we find Melancthon employed to draw up the celebrated confession of Augsburg; and such was the effect produced, that several of the Catholics acknowledged it could not be answered from the Scriptures; when an answer was at length prepared, the emperor, as if aware of its weakness on other grounds, declared authoritatively, that those were his sentiments, and he would no longer tolerate any who did not adopt them. The Apology for the Augsburg Confession was also written by our reformer, and with the same mixture of firmness and suavity: these qualities indeed were so conspicuous, as well as his great talents, at the conferences wnich were now frequently held with the Romish party, that they made several efforts to gain him over, but, as before, he stood firm in his attachment to the truth. It was at this momentous crisis, when the decree of the diet had been published, asserting the doctrines of popery, and condemning the Protestants, that the courage of Melancthon and his confidence in Divine assistance displayed themselves in a striking manner. While he and his friends were anxiously deliberating upon the best measures to be pursued, he was suddenly called out of the room. Some of the elders of the reformed churches had brought their friends and families to pray for and encourage the minds of their leaders, and even the children were seen engaged in prayer on their behalf. Encouraged by this scene he returned to his friends with so cheerful a countenance, that Luther rallied him upon it, and asked what had produced so sudden a change. 'O,' said Melancthon, 'I have seen our noble protectors, and such as, I will venture to say, will prove invincible against every foe.' 'And, pray,' said Luther, 'who are they?' 'They are the wives of our parishioners and their little children,' rejoined his colleague, 'whose prayers I have just witnessed—prayers which, I am satisfied, our God will hear.'

In the month of August, 1532, Melancthon was called to the office of delivering an oration at the funeral of the elector John, whom he deservedly styles a pious, firm, and peaceful prince, the father of his people. We afterwards find him delivering his decided opinion on the attempt of the pope and his nuncio to fix the meeting of a general council in Italy. In consequence of this advice the nuncio was informed, that, the controversy having been principally carried on in Germany, it was proper that the council should be assembled there. Two years after Melancthon was requested to undertake a journey, in order to confer with Bucer on the sacramental controversy; and in the same year his accustomed candor and meekness were displayed in a conference with certain of the Roman Catholic party, appointed by the archduke Ferdinand and duke George.

So universal was the fame of cur reformer that in the month of June, 1535, he received a pressing invitation from Francis I. of France, to visit his dominions, in order to discuss the subjects of difference between the Protestants and the papal see. Some of his friends (among whom was Luther) urged his compliance; but it was well perhaps for the Protestant cause that some impediments were interposed, as there is more than a doubt of the sincerity of the French court:—about this time, in consequence of some indiscreet reflections of the Protestants on the Romish clergy, six Lutherans were condemned to death by the parliament of that country, and actually suffered. The elector excused himself to the king for not sending him, on the plea that his services were more than ever necessary at home, as the academy at Wittemburg had been scattered by a pestilential disorder. Melancthon, however, wrote a small work on the best means of settling religious controversies, and sent it to the king. About the same time also Henry VIII. of England, having sent Dr. Barnes to consult the Saxon divines respecting his divorce from Catherine of Arragon, urged Melancthon to visit this country. Henry, it appears, was not a little jealous of his proposed visit to France, and made use of every means to draw him over to England. But our reformer, notwithstanding his own wish and that of Luther, that he should comply with this request, was obliged by the elector to refuse; and could only send to his royal correspondent letters of advice, and a copy of his Commentary on the Romans. In return, the latter wrote him a letter, expressing his approbation of his zeal in defence of religion, and presented him with 200 crowns, a large sum in those days. Henry's chief object in these negociations being to procure the sanction of his divorce from the Saxon divines, and neither Luther nor Melancthon being able to concur in it, the correspondence soon dropped. Our reformer, however, by this means became acquainted with some of the most celebrated leaders of the Reformation in England, particularly archbishop Cranmer.

In a journey undertaken for the benefit of his health, in 1536, Melancthon rendered essential service to the university of Tubingen by his advice relative to its religious and literary management. He also wrote at this time a treatise against the fanatical Anabaptists, who had produced great disturbances among the lower orders. Soon after his return home another conference was held between the Saxon and Swiss divines, upon the sacramentarian controversy, and he was appointed to draw up a formula on the subject; which all parties agreed in signing.

Melancthon was now (February, 1537) called upon to take a leading part at the meeting of Smalcald, held by the confederate Protestant princes, to deliberate on the propriety of attending the council, appointed by pope Paul III. for the 27th of May following; and incurred no little odium on account of his willingness to make concessions to the Catholics, for the sake of peace. But his work composed for this occasion, on the supremacy of the pope and the authority of bishops, manifested his firmness on essential points. He also wrote tne letters tha

passed between the princes and the king of France on the subject of this council. It was his pen, indeed, that was at this time used in drawing up almost all the authorised documents of the Protestant princes. A further attempt was made this year by the pope, through the means of cardinal Sadolet, to conciliate Melancthon; and Henry VIII. applied again for a deputation of the Saxon divines, and especially for a visit from our reformer; he was, however, too much occupied with other concerns; year after year passed away, and the journey was never accomplished. One of his letters to the king at this time boldly exposes those errors of popery which he still retained in his system, and which the English bishops greatly contributed to uphold. In 1540 he drew up a new and excellent defence of the Reformers, and soon after, while on his way to the diet at Spires, was taken so ill, that he appeared to Luther to be on the point of death. Alarmed at this, the latter broke out into the most ardent supplications, and then, turning to the patient, confidently assured him that he should not die; that God would raise him up. Strange as it may appear, while he was speaking, Melancthon evidently revived, and was soon after restored to health: he himself even says, 'I must have died, if Luther had not recalled me from the gates of death.'

At the conference which opened in the month of January 1541, at Worms, Melancthon was engaged in a dispute with Eckius; but, at the end of the third day, the emperor ordered his agent Granville to break up the meeting, appointing another at Ratisbon early in the spring. On his journey thither Melancthon, being overturned, dislocated the wrist of his right hand, and he never afterwards recovered the full use of it. In this meeting he again had a long debate with Eckius, during which his opponent, having brought forward some perplexing sophism, Melancthon paused to consider, and then said, 'I will give you an answer to morrow.' Eckius replied, 'But there is no honor in that: why cannot you answer me immediately.' 'My good doctor,' said Melancthon, 'I am not seeking my own glory in this business, but truth: I say, God willing, you shall have an answer to-morrow.' In the year 1542 we find him assisting at the ordination of a Protestant bishop, at Naumburg; and, early in the next year, he was engaged in a correspondence with the prince archbishop of Cologne, about the introduction of the reformed religion into his dominions. He visited Cologne, and, though the object proposed was not fully accomplished, much good was done, and the city of Hildesheim, in particular, embraced the Protestant doctrine. At this period many private and public trials oppressed his mind: the improper behaviour of one of his sons-in-law, and the death of his friend Valerius Cordus, the renewal of the sacramental controversy, in which Luther manifested unjustifiable violence of language, and the miserable state of the Protestants in France, all conspired to embitter his declining life. In 1545 he drew up a plan of proceeding for the elector palatine, who wished to introduce the Protestant doctrine into his country; and soon after assisted at the episcopal ordination of George, prince of Anhalt, who had devoted himself to the ministry of the gospel.

Melancthon, however, seems justly to have regarded the death of Luther, in 1546, as the most afflictive event that ever befel him. He expressed his feelings most powerfully in the affectionate and able oration delivered at the funeral of this great man: for not less than twenty-eight years had they lived and labored together in the same cause, and though they differred in some few of their sentiments, and were in many respects of very opposite dispositions, their harmony seems never to have been interrupted. In the month of November the university of Wittemburg being dissolved for a short time, in consequence of the war between the emperor and the Protestant princes, Melancthon retired, with his wife and family, to Yerbst, in Anhalt. Here he received repeated offers of a professor's chair in the university of Jena, but he could not bring his mind to forsake Wittemburg, and, in less than a twelvemonth, recommenced his lectures. In this year, also, the famous temporary rule of faith and worship, called the Interim, was published at Augsburg by order of the emperor Charles V., and afterwards enforced by the sword. To this document Melancthon replied, exposing its errors, and setting forth its miserable defects: his work was immediately translated into English. In the month of January 1552 he set out on his journey to the council of Trent, but soon was obliged to return in consequence of a war breaking out between the elector of Saxony and the emperor.

Melancthon now continued in his usual occupation at Wittemburg, occasionally attending different conferences, and composing most of the official documents that the Protestants promulgated. Truth compels us to add, that he was found approving the conduct of Calvin in the persecution of the miserable Servetus, the only apology for which is, that the principles of religious liberty were ill-understood by all parties; and that the reformers themselves were scarcely delivered, at this time, from the thraldom of a church in which persecution was professed and vindicated. The care of all the Protestant churches may be said now to have devolved on Melancthon, and he had frequently to meet his popish adversaries on the most important subjects. The last conference he attended was in 1557, at Worms; when the right of private judgment in matters of religion was discussed, and he manfully maintained the great principle of the Reformation, that the only authority to which human reason ought implicitly to submit, in religious concerns, is the infallible word of God. He then visited Heidelburg at the request of the elector palatine; and while there, surrounded by his friends, received the painful tidings of the death of his wife. He was now, in a great measure, weaned from the world, and, after a life of useful and even splendid public labors, closed his mortal career on the 19th of April 1560, in the sixty-fourth year of his age. He was interred at Wittemburg near his friend and associate Martin Luther. 'Nature,' says one of his biographers, 'had given him a peaceable temper,—

which was not altogether in accordance with the times in which he lived: his moderation often only served as his cross. He was like a lamb in the midst of wolves; nobody liked his mildness; it looked as if he were lukewarm.' The following is an epitaph he composed on himself:—

Iste brevis tumulus miseri tenet ossa Philippi,
Quis, qualis fuerit nescio, talis erat.

MELANIPPIDES, a Greek poet, who flourished about A.A.C. 520 His grandson, of the same name, flourished about sixty years after, at the court of Perdiccas II. of Macedonia. Some fragments of their poetry are extant.

MELAS (M. de), a modern Austrian general, who served with distinction against the French republic. In 1793 and 1794 he was a major-general, and then a lieutenant field-marshal on the Sambre. He was removed in 1795 to the army of the Rhine; and, in March 1796, to that of Italy. In 1799 he was at the head of the Austrian army, acting in concert with Suwarrow. He distinguished himself at Cassano, and was present at the battles of Trebia and Novi; he beat Championnet at Genola, November 3d, and took Coni. In 1809, however, he lost the battle of Marengo; but, though his conduct was censured, he was afterwards appointed commander in Bohemia. In 1806 he presided at the court of enquiry into the behaviour of general Mack at Ulm. Melas died at Prague in 1807.

MELASSO, a large town of Anatolia, the ancient Mylasa, and formerly so adorned with public buildings as to originate the story of the crier, who, on entering the market-place, instead of saying Hear, ye people, called out, Hear, ye temples. It is situated in a fertile plain; but the modern houses are mean. It is eighty miles south of Smyrna.

MELASTOMA, in botany, the American gooseberry tree, a genus of the monogynia order, and decandria class of plants; natural order seventeenth, calycanthemæ: CAL. quinquefid and campanulated; petals five, inserted into the calyx: BERRY quinquelocular, and wrapped in the calyx. There are many species, all natives of the warm parts of America, and very beautiful, from the variegation of their leaves. Most of them are of two different colors on their surfaces; the under side being either white, gold-colored, or russet, and their upper parts of different shades of green; so that they make a fine appearance in the hot-house all the year round. There are few of these plants in the European gardens, from the difficulty of bringing over growing plants from the West Indies; and the seeds being small, when taken out from the pulp of their fruits, rarely succeed. The best way is to have the entire fruits put up in dry sand as soon as they are ripe, and forwarded by the quickest conveyance to Britain. They should be taken out as soon as they arrive, and the seeds sown in pots of light earth, and plunged into a moderate hot-bed of tanner's bark. When the plants come up, and are fit to be removed, they must each be planted in a small pot, and plunged into the tan-bed; and afterwards treated as other exotic plants.

MELAZZO, or MILAZZO (the ancient Mylæ), a sea-port town of the north coast of Sicily, in the Val di Demona. It is built on a promontory, which has a good road on each side, and a well-sheltered capacious bay. The town, which is ill-built, is divided into two parts: the one on the promontory being strongly fortified, and the other at the harbour, near the bottom of the bay. Neither contains any buildings of note. The trade chiefly consists in the export of wine, olives, and olive oil, to Marseilles, Leghorn, and Genoa. The tunny fishery is also considerable. The neighbourhood, covered with villages and groves of olives and orange trees, bounded by the mountains of Pelorus, exhibits a most picturesque scene. Population 6000. Twenty miles west of Messina, and 100 east of Palermo.

MELCHIOR (Adam), a German biographer, born at Grotkaw, in Silesia, and educated at the college of Brieg. He was a Calvinist; was made rector of a college at Heidelberg, and wrote several works, particularly five volumes of the Lives of Illustrious Men, 1615—1620. He died in 1622.

MELCHISEDEC, or MELCHIZEDEC, king of Salem, and priest of the Most High. The scripture tells us nothing either of his father, mother, genealogy, birth, or death. And in this sense St. Paul says, he was a figure of Jesus Christ, 'who is a priest for ever, after the order of Melchisedec,' and not after the order of Aaron, whose origin, life, and death, are known. When Abraham returned from his victory over the four confederate kings, Gen. xiv. 17—19, &c., Melchisedec came to meet him, at the valley of Saveh; presented him with a refreshment of bread and wine, and blessed him, and Abraham offered him the tythes of all the spoils. After this no mention is made of Melchisedec; only the Psalmist (cx. 4), speaking of the Messiah, says, 'Thou art a priest for ever after the order of Melchisedec.' St. Paul, in his epistle to the Hebrews (vii. 6—10), unfolds the mystery. A great number of difficulties, however, have been started respecting the person of Melchisedec. St. Jerome thought that Salem, of which Melchisedec was king, was not Jerusalem, but the city of Salem, near Scythopolis, where they still pretended to show the ruins of his palace. The greatness and extent of these ruins are, he says, a proof of the magnificence of this ancient building. He thinks it was at this Salem, or Shelem, that Jacob arrived after his passage over Jordan, on his return from Mesopotamia. (Gen. xxxiii. 18). Some believe that Salem, where Melchisedec reigned, is the same as Salem mentioned by John, chap. iii. 23. Various names have been invented for the parents of Melchisedec. But it is generally agreed by the learned that when the apostle says (Heb. vii. 3), he was 'without father and without mother,' &c., no more is meant than that he derived his priesthood from no ancestral right, and handed it down to no posterity, or order of men. Nevertheless, some have taken St. Paul's words literally, and contend that he was not of human origin. Origen and Didymus took him to be an angel. The Arabic Catena, upon the ninth chapter of Genesis, makes Melchisedec to b

descended from Shem by his father, and from Japheth by his mother. Cedrenus and others derive Melchisedec from an Egyptian stock. They say his father was called Sidon, and was the founder of Sidon, the capital of Phœnicia. The Jews and Samaritans believed Melchisedec to be the same with the patriarch Shem; which opinion has been followed by many modern writers. M. Jurieu endeavoured to prove that he is the same as Ham. Peter Cunæus and du Moulin asserted that Melchisedec, who appeared to Abraham, was the son of God, and the patriarch worshipped him, and acknowledged him for the Messiah. We shall only add one opinion more concerning Melchisedec. The learned Heidegger supposes a two-fold Melchisedec; the one historical, of whom Moses gives an account in Gen. xiv. that he was king as well as high-priest of Jerusalem; the other allegorical, whom St. Paul describes, and this is Jesus Christ. Numberless other fables have been invented of Melchisedec, which are totally unworthy of notice.

MELCHISEDECIANS, a sect of heretics, who rose in the beginning of the third century, and affirmed that Melchisedec was not a man, but a heavenly power, superior to Jesus Christ: for Melchisedec, they said, was the intercessor and mediator of the angels, but Jesus Christ was so only for men, and his priesthood only a copy of that of Melchisedec, who was the Holy Ghost.

MELCHITES, in church history, the name given to the Syriac and Egyptian Christians. The Melchites, excepting some few points of little or no importance, which relate only to ceremonies and ecclesiastical discipline, are in every respect professed Greeks; but they are governed by a particular patriarch, who resides at Damas, and assumes the title of patriarch of Antioch. They celebrate mass in the Arabian language. The religious among the Melchites follow the rule of St. Basil, the common rule of all the Greek monks. They have four fine convents, about a day's journey from Damas, and never go out of the cloister.

MELCOMBE Regis, a town of Dorsetshire, 127 miles from London, at the mouth of the Wey, by which it is separated from Weymouth. It appears from the name to have been anciently the king's demesne, and from the records to have paid quit-rent to the crown, after the time of king Edward I. till it was bought off by the inhabitants before they were united to Weymouth. It lies on the north side of the haven, on a peninsula, surrounded by the sea on all sides except the north. The streets are broad and well paved, and many of the houses large and high. It sent members to parliament in the reign of Edward I. before Weymouth had that privilege. It was appointed a staple in the reign of Edward III. In the next reign the French burnt it; and it was thereby rendered so desolate, that the inhabitants obtained a discharge from customs. In the reign of Henry VI. its privileges, as a port, were removed to Pool; but in that of queen Elizabeth they were restored by act of parliament, which was confirmed by king James's reign, on condition that Melcombe and Weymouth should make but one corporation and borough, and enjoy their privileges in common; and to this was owing the flourishing state of both. In the two reigns last mentioned a wooden bridge with seventeen arches was built from hence to Weymouth; to which, as well as its church, the chief contributors were citizens of London. Upon its decay it was rebuilt in 1770. It has a good market place and town hall, to which the members of the corporation of Weymouth come to attend public business. For several years past the sea has retired from it on the east, the priory formerly being bounded by the sea; but there is now a street beyond it, from which it is several paces to the high water mark. The priory was situated in the east part of the town, in Maiden Street, whose site occupied about an acre, now covered with tenements. Near it are the remains of an ancient nunnery. It has three meeting-houses, and a work-house for the poor. The church, which is in the middle of the town, has a wooden turret for a bell. It was rebuilt in 1605, and made parochial; and is a handsome fabric, with a beautiful altar piece, painted and given by Sir James Thornhill. The port, which generally goes by the name of Weymouth, is the best frequented in the county, and is defended by Sandford and Portland castles. The markets for both towns are on Tuesday and Friday. Melcombe Regis is bigger, more thriving, and populous than Weymouth. The united corporation consists of a mayor, recorder, two bailiffs, an uncertain number of aldermen, and twenty-four capital burgesses. Whoever has been a mayor is ever after an alderman. They send two burgesses to parliament, who are elected by freeholders, whether they reside or not; and the number of inhabitants is 8200. Every elector has the privilege of voting for two persons, who, when chosen, are returned, in conjoint indentures, as the burgesses of Weymouth and the burgesses of Melcombe Regis. Melcombe lies eight miles south of Dorchester, and 127 W.S.W. of London. See Weymouth.

MELEAGER, in fabulous history, a celebrated hero, son of Œneus, king of Ætolia, by Althæa, daughter of Thestius. The Parcæ were present at his birth, and predicted his future greatness. Clotho predicted that he would be brave and courageous; Lachesis foretold his uncommon strength and valor; and Atropos said that he should live as long as that fire-brand which was on the fire remained entire and unconsumed. Althæa no sooner heard this, than she snatched the stick from the fire, and kept it with the most jealous care, to preserve the life of her son. The fame of Meleager increased with his years; he signalised himself in the Argonautic expedition, and afterwards delivered his country from the neighbouring inhabitants, who made war against his father at the instigation of Diana, whose altars Œneus had neglected. But Diana punished the negligence of Œneus by a greater calamity. She sent a huge wild boar, which laid waste all the country, and seemed invincible, on account of its immense size. All the neighbouring princes assembled to destroy this terrible animal. Among these, besides Meleager, were Idas and Lynceus, sons of Aphareus, Dryas son of Mars, Castor and Pollux, Piri-

thous son of Ixion, Theseus, Anceus, and Cepheus, sons of Lycurgus, Admetus son of Pheres, Jason, Peleus and Telamon sons of Æacus, Iphicles son of Amphitryon, Eurytryon son of Actor, Atalanta daughter of Schœneus, Iolaus the friend of Hercules, the sons of Thestius, Amphiarus son of Oileus, Protheus, Cometes, the brothers of Althæa, Hippothous son of Cercyon, Leucippus, Adrastus, Ceneus, Phileus, Echion, Lelex, Phœnix son of Amyntor, Panopeus, Hyleus, Hippasus, Nestor, Menœtius the father of Patroclus, Amphicides, Laertes the father of Ulysses, and the four sons of Hippocoon. This troop of heroes attacked the bear, and it was at last killed by Meleager. The conqueror gave the skin and the head to Atalanta, who had first wounded the animal. This irritated the rest, and particularly Toxeus and Plexippus the brothers of Althæa, and they endeavoured to rob Atalanta of the honorable present. Meleager defended her, and killed his uncles. Meantime the news of this celebrated conquest had already reached Calydon, and Althæa went to the temple to return thanks for the victory which her son had gained; but, being informed that her brothers had been killed by Meleager, she, in the moment of resentment, threw into the fire the fatal stick on which her son's life depended, and Meleager died as soon as it was consumed.

Meleager, a Greek poet, the son of Eucrates, was born at Seleucia in Syria, and flourished under Seleucus VI., the last king of Syria. He was educated at Tyre; and he died in the island of Coos, anciently called Merope. He there composed the Greek epigrams called Anthologia, which Planudes arranged in 1380.

MELEAGRIS, in ornithology, the turkey; a genus of birds belonging to the order of gallinæ. The head is covered with spongy caruncles, and there is likewise a membranaceous longitudinal caruncle on the throat.

M. gallopavo, the turkey of Ray, has a caruncle both on the head and throat; and the breast of the male is bearded or tufted. He lives upon grain and insects; when angry blows up his breast, spreads and erects his feathers, relaxes the caruncle on the forehead, and the naked parts of the face and neck become intensely red. Barbot informs us that very few turkeys are to be met with in Guinea, and those only in the hands of the chiefs of the European forts; the negroes declining to breed any, on account of their tenderness, which proves them not to be natives of that climate. Neither is that bird a native of Asia; the first that were seen in Persia were brought from Venice by some Armenian merchants. They are bred in Ceylon, but not found wild. It is the commonest wild fowl in North America, where they are often met with by hundreds in a flock. In the day time they frequent the woods, where they feed on acorns; and return at night to the swamps to roost on the trees. They are often taken by dogs, though they run fast for a time; but, the dogs persisting, the birds grow fatigued, and take to the highest trees, where they are shot one after another, if within gunshot. Turkeys were first seen in France in the reign of Francis I., and in England in that of Henry VIII. By the date of these reigns, the first turkeys must have been brought from Mexico, about A. D. 1521. Ælian mentions a bird found in India, which some writers have suspected to be the turkey; but Pennant concludes with Gesner, that it was either the peacock, or some bird of that genus. The hen begins to lay early in spring, and often produces a great number of eggs, which are white, marked with reddish or yellow spots, or rather freckles. She sits well, and is careful of her young; of which in this climate she often has from fourteen to seventeen for one brood; but she scarcely ever sits more than once in a season, except allured by putting fresh eggs under her as soon as the first set are hatched; for, as she is a close sitter, she will willingly remain two months on the nest, though this greatly injures her. Turkeys are bred in quantities in some northern counties of England, and are driven up to London in autumn for sale, in flocks of several hundreds, collected from the cottages about Norfolk, Suffolk, &c., the inhabitants of which attend carefully to them, by making them part of their family during the breeding season. It is curious to see with what facility the drivers manage them, by a bit of red rag fastened to a stick, which, from their antipathy to the color, has the same effect as a scourge to a quadruped. There are several varieties. The most common is dark gray, inclining to black, or barred dusky white and black. There is also a beautiful variety, of a fine deep copper color, with the greater quills pure white, and the tail of a dirty white. A variety with a pure-white plumage is also now frequent, and appears very beautiful. It was once esteemed a great rarity, and supposed originally to have arisen in Holland. In the Leverian museum is also a common turkey, with a large tuft of feathers on its head, much resembling one figured by Albin.

MELETIANS, in church history, a considerable party who adhered to the cause of Meletius, bishop of Lycopolis, in Upper Egypt, after he was deposed, about A. D. 366, by Peter, bishop of Alexandria, under the charge of having sacrificed to the gods, and been guilty of other heinous crimes; though Epiphanius makes his only failing to have been an excessive severity against the lapsed. This dispute, which was at first a personal difference between Meletius and Peter, became a religious controversy; and the Meletian party subsisted in the fifth century, but was condemned by the first council of Nice.

MELIA, Azaderach, or the bead-tree, in botany, a genus of the monogynia order and decandria class of plants; natural order twenty-third tribilatæ: cal. quinquedentated; the petals five: the nectarium cylindrical, as long as the corolla, with its mouth ten-toothed; the fruit is a plum with a quinquelocular kernel. There are three species, all exotic trees of the Indies, rising nearly twenty feet high, adorned with large pinnated leaves, and clusters of pentapetalous flowers. They are all propagated by seeds sown on hot-beds.

MELIANTHUS, honey-flower, in botany, a genus of the angiospermia order, and didynamia class of plants: cal. pentaphyllous, with the lowermost leaf gibbous: there are four petals, with the nectarium under the lowest: caps. quadrilocular.

1. M. major has a thick, ligneous, spreading root; many upright, ligneous, durable stalks, rising six or eight feet high; garnished with large pinnated leaves of four or five pair of serrated lobes, terminated by an odd one; and, from the sides and tops of the stalks, long spikes of chocolate-colored flowers.

2. M. minor has a root like the former; upright, ligneous, soft, durable stalks, rising four or five feet high; garnished with smaller pinnated leaves; and, from the sides and ends of the branches, long, loose, pendulous bunches of flowers tinged with green, saffron color, and red. Both species flower about June, but rarely produce seeds in this country. They are very ornamental, both in foliage and flower, and merit admittance in every collection. They are easily propagated by suckers and cuttings. They thrive best in a dry soil, and a sheltered warm exposure.

MELIBOEA, in ancient geography, an island of Syria, at the mouth of the Orontes; which forms a spreading lake round it. It was famous for its purple dye; and is supposed to have been originally a Thessalian colony. Hence Lucretius's epithet, Thessalicus.

MELICA, rope-grass, a genus of the digynia order, and triandria class of plants: CAL. bivalved, biflorous, with an embryo of a flower betwixt the two florets. There are many species, of which the most remarkable are,

M. altissima, and ciliaca, which thrive on the most barren hills, and are much relished by cattle. M. cerulea affords an excellent substitute for hair in the manufacture of brooms. M. nutans is a native of several parts of Britain and the adjacent islands; and the inhabitants of some of the western islands make ropes of it for fishing-nets, as it will bear the water long without rotting.

MELICE'RIS, *n. s.* Gr. μελικηρις.

Meliceris is a tumour inclosed in a cystis, and consisting of matter like honey. If the matter resembles milk curds, the tumour is called atheroma; if like honey, *meliceris*: and if composed of fat, or a suety substance, steatoma. *Sharp.*

MELICERTA, MELICERTES, or MELICERTUS, in mythology, a son of Athamas and Ino. His mother saved him from his father's fury, who prepared to dash him against a wall, as he had done his brother Learchus. The mother was so terrified that she threw herself into the sea with Melicerta in her arms. Neptune had compassion on the misfortunes of Ino and her son. He changed them both into sea deities. Ino was called Leucothoë or Matuta; and Melicerta was called by the Greeks Palemon, and by the Latins Portumnus. Some suppose that the Isthmian games were instituted in honor of Melicerta.

MELINDA, a kingdom on the east coast of Africa, situated between lat. 3° and 4° S., though there is great disagreement among geographers as to its extent, and it is altogether but little known. The coasts here are very dangerous; being full of rocks and shelves, and the sea at various seasons very liable to tempests. The interior is said to be for the most part rich and fertile; producing almost all the necessaries of life, except wheat and rice, both of which are brought thither from Cambaya and other parts potatoes are here fine, large, and in great plenty It also abounds with great variety of fruit-trees, roots, plants, and other esculents, and with melons of fine taste. There is also great plenty of venison, game, oxen, sheep, hens, geese, and other poultry, &c., and one breed of sheep, whose tails weigh between thirty and forty pounds. Here Vasco de Gama, having doubled the Cape, met with a hospitable reception, and was supplied with pilots to conduct him to Malabar. Cabral and several of his successors also met with friendly treatment on this coast. The Portuguese, however, as their power extended, became too haughty to be tolerated even by friendly powers. A quarrel arose: Melinda was taken and destroyed by them, and, when it was rebuilt, became one of their tributaries; till about 1698, when it was wrested from them by the Arabs.

Melinda, the capital, is a large handsome town, having houses built of stone, and many of them richly furnished. The numerous mosques give it a splendid appearance from the sea; but most of the churches and buildings erected by the Portuguese are in ruins. At the mouth of the Quillimany it has a good port, but it is difficult of access from shoals. Still it is the seat of a very considerable trade with the Red Sea, Persia, and the northern parts of India. The exports are gold, ivory, copper, wax, and drugs; in exchange for which they receive silks, cottons, linen cloths, and European goods.

MELINUM, in natural history, the name of an earth famous in the earliest ages of painting, being the only white of the great painters of antiquity; and, according to Pliny's account, one of the three colors with which alone they performed all their works. It is a fine, white, marly earth, of a very compact texture, yet remarkably light; a sort of texture which must render any earth fit for the painter's use that is of a proper color. It is often found forming a stratum in the earth, lying immediately under the vegetable mould. It is of a very smooth, but not glossy surface; is very soft to the touch; adheres firmly to the tongue; is easily broken between the fingers; and stains the skin in handling. It melts readily in the mouth, and is perfectly fine; leaving not the least grittiness between the teeth; thrown into water, it makes a loud bubbling and hissing noise, and moulders away into a fine powder. It does not ferment with acids; and suffers no change in the fire. These are the characters by which the melinum of the ancients is distinguished from all other white earths. It is still found in the same place from which the painters of old had it, viz. the isle of Milo or Melos, whence it had its name; and is common in most of the adjacent islands.

ME'LIORATE, *v. a.*
MELIORA'TION, *n. s.*
MELIOR'ITY.
Fr. *ameliorer*; Latin *melior*, better. To make better, or happier; improve. Melioration is the act or habit of improving. Meliority, state of being better.

Grafting *meliorates* the fruit; so that the nourishment is better prepared in the stock than in the crude earth. *Bacon.*

For the *melioration* of musick there is yet much left to try. *Id.*

Men incline unto them which are softest, and least in their way, in despight of them that hold them hardest to it; so that this colour of *meliority* and pre-eminence is a sign of weakness. *Bacon.*

But when we graft our buds inoculate,
Nature by art we nobly *meliorate*. *Denham.*

Castration serves to *meliorate* the flesh of those beasts that suffer it. *Graunt.*

Much labour is required in trees;
Well must the ground be digged, and better dressed,
New soil to make, and *meliorate* the rest. *Dryden.*

A man ought by no means to think that he should be able so much as to alter or *meliorate* the humour of an ungrateful person by any acts of kindness. *South.*

The order and beauty of the inanimate parts of the world, the discernible ends of them, the *meliority* above what was necessary to be, do evince, by a reflex argument, that it is the workmanship, not of blind mechanism, but of an intelligent and benign agent. *Bentley.*

Past indiscretion is a venial crime,
And if the youth, unmellowed yet by time,
Bore on his branch luxuriant then and rude
Fruits of a blighted size, austere and crude,
Maturer years shall happier stores produce,
And *meliorate* the well-concocted juice. *Cowper.*

MELIPILLA, a town and province of Chili, bounded on the north by Quillota, on the east by Santiago, on the south by the river Maypo, which divides it from Rancagua, and on the west by the sea. The province, abounding with wine and grain, is of small extent upon the sea, but is about twenty-five leagues from east to west. Its rivers are the Mapocho and Poangue. The town is near the Mapocho, and has a church and several monasteries; but is thinly peopled. The Jesuits had a college here.

MELISSA, in mythology, a daughter of Melissus, king of Crete, who, with her sister Amalthæa, fed Jupiter with the milk of goats. She first found out the means of collecting honey; whence it has been fabled that she was changed into a bee, as her name, Μελισσα, is the Greek for that insect.

Melissa, Baum, a genus of the gymnospermia order, and didynamia class of plants: cal. arid, a little plane above, with the upper lip having its dents nearly of equal height: cor. upper lip, arched and bifid; the under one, with the middle lobe, cordated: the most remarkable species are,

1. M. calamintha, or common calamint of the shops, with fibrous perennial roots; upright, square, branchy, hairy stalks, rising a foot high; roundish, indented, opposite leaves; and verticillate clusters of small bluish flowers, on forked foot-stalks, as long as the flowers.

2. M. grandiflora, or Hetrurian calamint, with fibrous perennial roots and annual stalks, rising about a foot high, garnished with oblong, oval, indented, hairy, opposite leaves; and from the upper axillæ verticillate clusters of large purple flowers on forked foot-stalks.

3. M. officinalis, or common baum, with fibrous perennial roots; many upright, square, branchy, annual stalks, rising two or three feet high; garnished with oblong, indented, opposite leaves, by pairs, two or three inches long, and half as broad; and from the upper axillæ verticillate clusters of small white flowers upon single foot-stalks. There is also a variety with variegated leaves. All these species are easily propagated by off-sets. This last, when in perfection, has a pleasant smell, somewhat of the lemon kind; and a weak, roughish, aromatic taste. The young shoots have the strongest flavor; the flowers, and the herb itself, when old or produced in very rich moist soils or rainy seasons, are much weaker both in smell and taste. Baum is appropriated, by the writers on the materia medica, to the head, stomach, and uterus; and, in all disorders of these parts, is said to be very serviceable.

MELISSUS of Samos, a Greek philosopher, was the son of Ragines and the disciple of Parmenides; and lived about 440 B.C. He asserted that the universe is infinite, immoveable, and without a vacuum. Themistocles was among his pupils.

MELITA, or Melite, in ancient geography, an island referred to Africa by Scylax and Ptolemy; but nearer Sicily, and allotted to it by the Romans; commended for its commodious harbours, for a city well built, and for weavers of fine linen. The Phœnicians were the first colonists. It is now called Malta.

MELITENSIS Terra, the earth of Malta, an earth of which there are two very different kinds; the one of the genus of boles, the other of marls. The latter is that known by medicinal authors under this name; the former is the Malta earth now in use; but both, being brought from the same place, are confusedly called by the same name. The Maltese marl, which is the terra Melitensis of medicinal authors, is a loose, crumbly, and very light earth, of an unequal and irregular texture, and when exposed to the weather, soon falls into fine soft powder; but, when preserved and dried, it becomes a loose, light mass, of a dirty white color, with a grayish cast: it is rough to the touch, adheres firmly to the tongue, is very easily crumbled to powder between the fingers, and stains the hands. Thrown into the water, it smells, and afterwards moulders away into a fine powder. It ferments very violently with acid menstruums. Both kinds are found in great abundance in the island, and the latter has been much esteemed as a remedy against the bites of venomous animals. The other has supplied its place in the German shops; and is used there as a cordial, sudorific, and astringent.

MELITO, bishop of Sardis in Lydia, in the second century, was remarkable for the apology he presented to the emperor Aurelius, in favor of the Christians; on which Eusebius and other ancient ecclesiastical writers bestow great praises; but that and all Melito's other works are lost.

MELITTIS, in botany, baum-leaved archangel, or bastard baum, a genus of the gymnospermia order, and didynamia class of plants; natural order forty-second, verticillatæ.

MELITUS, a Greek orator and poet, the accuser of Socrates. The Athenians, after the death of Socrates, discovering the iniquity of the sentence they had passed against that great philosopher, put Melitus to death, 400 B.C.

MELL, *v. n.* Fr. *meler*. To mix; meddle. Obsolete.

> In no wise dare I more *mell*
> Of thing wherein such peril is
> As like is now, to fall of this.
> *Chaucer's Dreame.*

> It fathers fits not with such things to *mell*.
> *Spenser.*

> Here is a great deal of good matter
> Lost for lack of telling:
> Now I see thou dost but clatter,
> Harm may come of *melling*. *Id. Pastorals.*

MELLAN (Claude), an engraver of considerable note, born at Abbeville in Picardy in 1601. His father was the receiver of the customs in that town, and took great care of his education. His genius for drawing appearing very early, he was sent to Paris, and placed under the direction of Simon Vouet, to perfect him in that art, and his studies promised success; but he was diverted from his application to them by the desire he had of learning the management of the graver, which he acquired with much facility. From Paris, at the age of sixteen, he went to Rome, where he engraved a considerable number of plates, many of which are held in great estimation; particularly those for the Justinian Gallery, the portrait of the marquis Justinian, and that of pope Urban VIII. Returning to France, he married and settled at Paris, in 1654. Louis XIV., being made acquainted with his merit, assigned him apartments in the Louvre, in the double quality of a painter and an engraver. He acquired a competent fortune, and was greatly esteemed. He died in 1688, aged eighty-seven.

MELLIF'EROUS, *adj.* } Lat. *mellifico*, or
MELLIFICA'TION, *n. s.* } *mel* (Gr. μελι) and
MELLIF'LUENCE, } *fluo*. Flowing with
MELLIF'LUENT, *adj.* } honey. Production
MELLIF'LUOUS. } of honey; flowing
with honey or sweetness: this is the sense of all the adjectives. Mellification is the art of making, or the production of honey. Mellifluence, a honied or sweet flow.

MELLITE, or **HONEY-STONE**, in mineralogy, takes its name from its yellow color, like that of honey. Its primitive figure is an octahedron. The crystals are small; their surface is commonly smooth and shining. Internally, it is splendent. It is transparent, passing into the opaque, and possesses double refraction. It is softer than amber, and brittle. Specific gravity 1.5. to 1.7. It becomes electric by friction. It occurs on bituminous wood and earthy coal, at a single locality in Thuringia. It consists of 46 mellitic acid, 16 alumine, and 38 water.

MELLITIC ACID; discovered by Klaproth in the mellite, or honey-stone. It is procured by reducing the mellite to powder, and boiling it with about 72 times its weight of water; the alumine is precipitated in the form of flakes, and the acid combines with the water. By filtration and evaporation, crystals are deposited, in the form of fine needles, or in small, short prisms. It is composed of carbon, hydrogen, and oxygen. In combination with the earthy alkalies and metallic oxides, it forms compounds called *mellates*.

MEL'LOW, *adj.*, *v.a.* & *v.n.* } French *mol*,
MEL'LOWNESS. } *moelleux*; Ital.
and Span. *molle*; Port. *mole*; all perhaps of Lat. *mollis*, soft. Ripe to softness; mature; soft in sound; unctuous; subdued or melted down by drink; intoxicated. To mellow is to ripen; mature; bring to or towards perfection: hence to ameliorate; make better in any way; be matured; ripen. Mellowness follows these senses.

An apple in my hand works different effects upon my senses: my eye tells me it is green; my nose, that it hath a *mellow* scent; and my taste, that it is sweet. *Digby.*

> The spring, like youth, fresh blossoms doth produce,
> But Autumn makes them ripe, and fit for use:
> So age a mature *mellowness* doth set
> On the green promises of youthful heat. *Denham.*

> Greedy of physicians frequent fees,
> From female *mellow* praise he takes degrees.
> *Roscommon.*

> A little longer,
> And Nature drops him down without your sin,
> Like *mellow* fruit, without a winter storm.
> *Dryden.*

> Of seven smooth joints a *mellow* pipe I have,
> Which with his dying breath Damætas gave. *Id.*

They plow in the wheat stubble in December; and, if the weather prove frosty to *mellow* it, they do not plow it again till April. *Mortimer's Husbandry.*

> On foreign mountains may the sun refine
> The grape's soft juice, and *mellow* it to wine.
> *Addison.*

> In all thy humours, whether grave or *mellow*,
> Thou'rt such a testy, touchy, pleasant fellow:
> Hast so much wit, and mirth, and spleen about thee,
> There is no living with thee, nor without thee. *Id.*

> When thou wast corn't, an' I was *mellow*,
> We took the road aye like a swallow:
> At Brooses thou had ne'er a fellow. *Burns.*

> As time improves the grape's authentic juice,
> *Mellows* and makes the speech more fit for use,
> And claims a reverence in its shortening day,
> That 'tis an honour and a joy to pay. *Cowper.*

> The rose was yet upon her cheek,
> But *mellowed* with a tenderer streak:
> Where was the play of her soft lips fled?
> Gone was the smile that enlivened the red.
> *Byron.*

MELMOTH (William), esq., a learned bencher of Lincoln's Inn, was born in 1666. In conjunction with Mr. Peere Williams, he published Vernon's Reports, under an order of the court of chancery. But the performance for which he most deserves to be held in remembrance is, The Great Importance of a Religious Life; of which, after many large editions had been circulated, 42,000 copies were sold within eighteen years, before the real author was known. Few men, it has been truly said, have ever passed a more useful, not one a more blameless life. He died on the 6th of April, 1743.

MELMOTH (William), esq., son of the preceding, the celebrated translator of Pliny and of Cicero's Letters; and author of those which pass under the name of Sir Thomas Fitzosborne.

MELOCHIA, Jews' mallow, in botany, a genus of the pentandria order, and monodelphia class of plants: CAPS. quinquelocular and monospermous. There are several species; but the only remarkable one is,

M. olitorius, the common Jew's mallow, a native of the warm parts of Asia and America. It is an annual plant, which rises about two feet high, dividing into several branches, garnished with leaves of different sizes and forms: some spear-shaped, others oval, and some almost heart-shaped: they are of a deep green, and slightly indented on their edges, having near their base two bristly reflexed segments. They have very long slender foot-stalks, especially those which grow on the lower part of the branches. The flowers sit close on the opposite side of the branches to the leaves, coming out singly; they are composed of five small yellow petals, and a great number of stamina surrounding the oblong germen, which is situated in the centre of the flower, and afterwards turns to a rough swelling capsule two inches long, ending in a point, and having four cells filled with angular greenish seeds. This species is cultivated about the city of Aleppo in Syria, and in the East Indies, as a pot-herb; the Jews boiling the leaves, and eating them with their meat. It is supposed by Rauwolf to be the olus Judaicum of Avicenna, and the corchorum of Pliny.

MELOCO'TON, *n. s.* Spanish *melocotone;* Lat. *malum cotoneum.* A quince. Obsolete.

In apricots, peaches, or *melocotones* upon a wall, the greatest fruits are towards the bottom. *Bacon.*

MEL'ODY, *n. s.* } Fr. *melodie:* Latin
MELO'DIOUS, *adj.* } *melodia;* Gr. μελῳδια.
MELO'DIOUSLY, *adv.* } Music; harmony or
MELO'DIOUSNESS, *n. s.* } sweetness of sound:
the other derivatives correspond.

Singing and making *melody* in your hearts to the Lord. *Ephesians.*

The prophet David having singular knowledge not in poetry alone but in musick also, judging them both to be things most necessary for the house of God, left behind him a number of divinely indited poems, and was farther the author of adding unto poetry *melody* in public prayer, *melody* both vocal and instrumental, for the raising up of men's hearts, and the sweetening of their affections towards God. *Hooker.*

Why rather, sleep, liest thou in smoky cribs,
And husht with buzzing night flies to thy slumber;
Than in the perfumed chambers of the great,
And lulled with sounds of sweetest *melody?*
Shakspeare.

Fountains! and ye that warble, as ye flow,
Melodious murmurs; warbling tune his praise.
Milton.

And oft with holy hymns he charmed their ears;
A musick more *melodious* than the spheres.
Dryden.

Lend me your songs, ye nightingales: Oh pour
The mazy-running soul of *melody*
Into my varied verse! *Thomson's Spring.*

The lover, in *melodious* verses,
His singular distress rehearses,
Still closing with a rueful cry,
Was ever such a wretch as I! *Cowper.*

MELOE, in zoology, a genus of insects of the order of coleoptera. The antennæ are jointed, the last joint being oval; the breast is roundish; the elytra are soft and flexible; and the head is inflected and gibbous. This genus is divided into two families; one without wings, and having the elytra shorter than the abdomen; the other winged, with elytra shorter than the body, and wholly covering the wings. See ENTOMOLOGY.

M. proscarabæus, the color is black, but without brightness, though intermixed with a small degree of purple, especially towards the under part of the body. Its head, which is large is dotted; as is the thorax, which is narrower, round, and has no margin. The elytra are as soft as leather, shagreened, and cover but one part of the abdomen. They seem cut off obliquely from the inner to the outer part, being shorter towards the suture, longer on the sides. There are no wings under the elytra. The abdomen is large, especially that of the female, in which it far exceeds the elytra. This insect makes its abode on the side of wet roads and in woods. Its food is insects, violet leaves, and delicate herbs. A fat unctuous matter of an agreeable smell oozes from its body. The males are less than the females. Oil, in which insects of this species have been infused, is said to be an excellent remedy for wounds and the scorpion's sting. It enters also into the composition of salve for plague sores. The insects bruised and mixed with oil or honey, Linnæus says, are recommended as a remedy in the rabies canina. See ENTOMOLOGY.

ME'LON, *n. s.* Fr. *melon;* Lat. *melo.* A species of cucumis. See below.

We remember the fish which we did eat in Egypt freely; the cucumbers and the *melons.* *Num.* xi. 5.

The southern wits are like cucumbers, which are commonly all good in their kind; but at the best are an insipid fruit; while northern geniuses are like *melons,* of which not one in fifty is good; but when it is, it is an exquisite relish. *Berkeley.*

The flower of the *melon* consists of one leaf, which is of the expanded bell shape, cut into several segments, and exactly like those of the cucumber, &c. *Miller.*

MELON, in botany. See CUCUMIS. The female flowers have no stamina or summits, but have a very large oval germen, situated below the flower, which turns to an oval fruit with several cells, filled with oval, acute pointed, compressed seeds, enclosed in a soft pulp. Great varieties of this fruit are cultivated in different parts of the world, many of them of no value, size being regarded too much in the markets. The cantaleupe melon, so called from a place near Rome, where this fruit has been long cultivated, and whither it was brought from Armenia, is in the greatest esteem among the curious. There are also the romana, the succadoe, the Zatte, the small Portugal or dormer, and the black Galloway melons, most of which are cultivated for an early crop. The proper management and culture of melons are as follow:—The seed from which they are to be propagated should be from three to six years old, sown at two different periods, to obtain a succession of crops. For those of the first season the seed may be set about the middle of February, on a cucumber bed, two inches from each other, and covered with a little earth. When a fortnight old they should be transplanted, and, in three weeks after, finally removed to the bed on which they are intended to remain, which ought to be in a warm situation, so as to be defended

from cold and violent winds. The second crop should be sown about the middle of March, and treated in a similar manner. But the hot-bed, formed with the view of rearing these tender exotics, ought to evaporate two or three days before it be ready for the reception of the plants; which should be carefully removed without injuring their fibres. After they are placed on the tops of the hills, raised of garden-mould above the dung, water them once or twice till they have taken root, when their management will vary but little from that of cucumbers, excepting that melons require more air and a small quantity of water. As soon as the plant spreads into branches it must be properly clipped: so that only two of the principal shoots may remain; and, to produce perfect and ripe fruit, one only should be left on each stem, and all superfluous young melons removed as soon as they appear. Besides, the diseased leaves and branches, together with the forked extremities, ought to be continually cut off; and when the fruit is set, or formed, it will be necessary to place thin boards or stones under each, and to turn it gently twice a-week, that the whole may be equally benefited by the sun and air. When fully grown, it must be plucked at a proper time, as it will otherwise lose a considerable part of its flavor. Thus, if melons be intended for the table they should be cut early in the morning, immersed in ice or cold spring water, and kept in the coolest place till they are used. The most certain criterion, to ascertain the maturity of this fruit, is its cracking near the foot-stalk, and beginning to smell.

MELOS, in ancient geography, an island between Crete and Peloponnesus, about twenty-four miles from Scyllæum. It is about sixty miles in circumference, and of an oblong figure. It enjoyed independence for above 700 years befor the Peloponnesian war. It was originally peopled by a Lacedemonian colony, about A.A.C. 1116. For this reason the inhabitants refused to join the rest of the islands and the Athenians against the Peloponnesians. This refusal was severely punished. The Athenians took Melos, and put to the sword all who were able to bear arms. The women and children were made slaves, and the island desolated. An Athenian colony repeopled it, till Lysander reconquered it, and restored the inhabitants to their possessions. It is now called Milo, as well as its capital. See MILO.

MELOTHRIA, in botany, small creeping cucumber, a genus of the monogynia order and triandria class of plants; natural order thirty-fourth, cucurbitaceæ: CAL. quinquefid: COR. campanulated and monopetalous; berry trilocular and monospermous. There is only one species, viz.

M. pendula, a native of Carolina, Virginia, and many of the American islands. The plants strike out roots at every joint, which fasten their stalks in the ground, by which means they extend far every way. The flowers are very small, shaped like those of the melon, of a pale sulphur color. The fruit in the West Indies grows to the size of a pea, is of an oval figure, and changes to black when ripe: these are by the inhabitants sometimes pickled when green. In Britain the fruit are much smaller, and are so hidden by the leaves that it is difficult to find them. The plants in this country require artificial heat.

MELPOMENE, in mythology, one of the nine muses, daughter of Jupiter and Mnemosyne. She presided over tragedy. Horace has addressed one of the finest of his odes to her, as to the patroness of lyric poetry. She was generally represented as a young woman with a serious countenance. Her garments were splendid; she wore a buskin, and held a dagger in one hand, and in the other a sceptre and crown.

MELROSE, a town of Roxburgh, on the confines of Tweeddale; seated on the south side of the Tweed; with an ancient abbey, now in ruins, founded by king David I. in 1136. He peopled it with Cistertians from Rivale abbey in Yorkshire, and dedicated it to the Virgin Mary. At the Reformation James Douglas was made commendator, who took down much of the building, to furnish materials for a large house for himself, which still remains. Nothing is left of the abbey excepting a part of the cloister walls elegantly carved; but the ruins of the church are most strikingly beautiful. Part is at present used for divine service, the rest uncovered; but every part does great honor to the architect. Alexander II. was buried beneath the great altar. This ancient monastery is mentioned by Bede, as having been founded in the end of the sixth century; and Sir Walter Scott's description of it, in the Lay of the Last Minstrel, has attracted numbers of travellers to the spot. Sir Walter's seat of Abbotsford is in the immediate vicinity. Melrose has fairs in March, June, August, and November.

MELT, *v. a.* & *v. n.*
MELT'ER, *n. s.*
MELT'ING, *adj.*
MELT'INGLY, *adv.*
} Sax. meltan; Goth. and Swed. *melta*; Belg. *smelten*; Gr. *μελδω*. To dissolve; make or reduce into liquid: hence to break into small particles; waste; and metaphorically to soften to regard or tenderness; waste away: as a neuter verb, to become liquid; be dissolved or lose substance; be softened into compassion, tenderness, or gentleness. A melter is particularly applied to one that smelts metals. Melting and meltingly follow the senses of the verb.

My soul *melteth* for heaviness: strengthen thou me. *Psalm.*

When the *melting* fire burneth, the fire causeth the waters to boil. *Isa.* lxiv. 2.

Miso and Mopsa, like a couple of foreswat *melters*, were getting the pure silver of their bodies out of the ore of their garments. *Sidney.*

Zelmane lay upon a bank, that her tears falling into the water, one might have thought she began *meltingly* to be metamorphosed to the running river. *Id.*

How they would *melt* me out of my fat drop by drop, and liquor fishermen's boots with me. *Shakspeare.*

Thou would'st have plunged thyself
In general riot, *melted* down thy youth
In different beds of lust. *Id. Timon of Athens.*

Dighton and Forrest,
Albeit they were flesht villains, bloody dogs,

Melting with tenderness and mild compassion,
Wept like two children in their death's sad story.
Shakspeare.

Whither are they vanished?
—Into the air: and what seemed corporal
Melted as breath into the wind. *Id. Macbeth.*

The rose is fragrant, but it fades in time;
The violet sweet, but quickly past the prime;
While lillies hang their heads and soon decay,
And whiter snow in minutes *melts* away.
Dryden.

The mighty master smiled to see
That love was in the next degree:
'Twas but a kindred sound to move,
For pity *melts* the mind to love. *Id.*

Melting into tears, the pious man
Deplored so sad a sight. *Id.*

This price, which is given above the value of the silver in our coin, is given only to preserve our coin from being *melted* down. *Locke.*

To take in pieces this frame of nature, and *melt* it down into its first principles; and then to observe how the divine wisdom wrought all these things into that beautiful composition; is a kind of joy which pierceth the mind. *Burnet.*

Alas! the story *melts* away my soul, *Addison.*

This the author attributes to the remissness of the former *melters*, in not exhausting the ore.
Derham's Physico-Theology.

The rock's high summit in the temple's shade,
Nor heat could *melt*, nor beating storm invade.
Pope.

If your butter wnen *melted* tastes of brass, it is your master's fault, who will not allow you a silver saucepan. *Swift.*

What with afflicted beauty can compare,
And drops of love distilling from the fair?
It *melts* us down; our pains delight bestow,
And we with fondness languish o'er our woe.
Young.

MELVILLE ISLAND in the North Polar Sea; one of the North Georgian group, between 74° and 76° 50' N., lat., and 105° 40', and 113° 40' W., long. It is surrounded with enormous masses of ice, and the only vegetation is moss. Captain Parry discovered it in 1819, and passed the winter of 1819—20 there.

MELTING CONE, in assaying, a hollow cone of brass or cast iron, into which melted metalline substances are thrown, in order to free them from their scoriæ. When a small quantity of matter is melted it will be sufficient to rub the inside of the cone with grease; but when the quantity is very large, especially if it contain any thing sulphureous, this caution of tallowing the moulds is not sufficient. In this case the assayer has recourse to a lute reduced to thin pap with water, which effectually prevents any injury to the cone.

MELVIL (Sir James), descended from an honorable Scots family, being the third son of the laird of Kaeth, was born in 1530. He went to France very young, as page to queen Mary, then married to the dauphin; and on the death of her husband followed her to Scotland, where he was made gentleman of her chamber, and admitted a privy counsellor. She employed him in her most important concerns, till her confinement in Lochleven, all which he discharged with the utmost fidelity; and, had she taken his advice, she might have avoided many of her misfortunes. When she was prisoner in England, she recommended him strongly to her son James with whom he continued in favor and employment until the death of queen Elizabeth: James would then have taken him to England; but Melvil, now grown old, was desirous of retiring from business, and in his retirement he drew up the memoirs of his past life for the use of his son. These Memoirs were accidentally found in Edinburgh castle in 1660, and published in folio in 1683.

MELVILLE BAY, a harbour on the north coast of New Holland, in the west entrance of the gulf of Carpentaria, said by captain Flinders to be the best harbour in the gulf. The entrance from the N. N. W. is four miles wide; and the bay every where affords good anchorage. On the south and eastern sides the country was found covered with pasturage and trees. Among the latter kangaroos appeared to be numerous. Long. of Point Dundas, at the entrance of the bay, 136° 41' 40" E., lat. 12° 13' 0" S.

MELVILLE, CAPE, the north-west point of Hispaniola. Long. 60° 30' W., lat. 15° 44' N.

MELVILLE ISLES are formed of an island, with several smaller rocky islets adjoining, on the north shore of New Holland, at the entrance into the gulf of Carpentaria. The island is low, about five miles long, and between one and two in breadth. It is barren, and the shores in general are sandy. The south end lies in long. 136° 52' E., lat. 12° 8' 30" S.

MELUN, an ancient and handsome town, the principal place of the department of the Seine et Marne, in France, having a minor court of justice, subject to the royal court of Paris, a communal college, a free drawing school, an agricultural society, a public library of 8000 volumes, an assembly room, and several pleasant public walks. It is a post town, situated at the foot of a hill, containing about 7000 inhabitants: the river Seine running through it and dividing it into several parts. It has tolerably open streets: in the eastern part of the Isle of France, near it, are the ruins of a palace, once inhabited by the French monarchs, and where Blanche, the mother of St. Louis, for some time held her court. Melun was besieged and taken several times by the English and by the duke of Burgundy; the former reduced it by famine in 1419, but fourteen years after the inhabitants drove them out and admitted the troops of Charles VII.

Its manufactures consist of flint glass, cloth, drugget, serge, printed linens, calicoes, &c. &c. There are also some cotton spinning factories, tan-yards and bark-mills, lime-kilns, &c. The inhabitants carry on a trade in corn, flour, wines, cheese, wool, and cattle. There is a considerable corn-market here for the supply of Paris, and a central jail for five departments. Near this place was born James Amyot, the translator of Plutarch. It is situated twelve miles north of Fontainbleau, thirty-nine south of Meux, and thirty-four S. S. E. of Paris.

MEM'BER, *n. s.* Fr. *membre;* Ital. *membro;* Lat. *membrum:* [Ex. Gr. μερος, quòd membra sint partes corporis; qu. per redupl. μεμερος?—Ainsworth.] Any part of a thing or person: an obvious or conspicuous part: hence a limb; in-

tegral or principal part of a discourse or poem; an architectural division of a column, capital, &c.; one of a community.

It is profitable for thee that one of thy *members* should perish, and not that thy whole body should be cast into hell. *Matthew.*

My going to demand justice upon the five *members*, my enemies loaded with obloquies. *King Charles.*

If shape it might be called, that shape had none,
Distinguishable in *member*, joint, or limb. *Milton.*

Mean as I am, yet have the Muses made
Me free, a *member* of the tuneful trade. *Dryden.*

In poetry, as in architecture, not only the whole but the principal *members*, should be great. *Addison.*

Sienna is adorned with many towers of brick, which, in the time of the commonwealth, were erected to such of the *members* as had done service to their country. *Addison.*

The peace and happiness of a society depend on the justice and fidelity, the temperance and charity, of its *members*. *Rogers.*

Where the respondent limits or distinguishes any proposition, the opponent must prove his own proposition according to that *member* of the distinction in which the respondent denied it. *Watts.*

MEM'BRANE, *n. s.* | MEMBRANA'CEOUS, *adj.* | MEMBRA'NEOUS, | MEM'BRANOUS. } French *membrane*, *membraneux*; Latin *membrana*, (that which binds together the members.—Priscian.) A fibrous integument of the body. See the extract from Quincy. The adjectives mean consisting of, or pertaining to, membranes.

They obstacle find none
Of *membrane*, joint, or limb, exclusive bars:
Easier than air with air, if spirits embrace,
Total they mix. *Milton.*

The chorion, a thick *membrane* obscuring the formation, the dam doth after tear asunder.
Browne's Vulgar Errours.

Great conceits are raised of the involution or *membranous* covering called the silly-how. *Browne.*

The inner *membrane* that involved the several liquors of the egg remained unbroken. *Boyle.*

Lute-strings, which are made of the *membraneous* parts of the guts strongly wreathed, swell so much as to break in wet weather. *Id.*

Such birds as are carnivorous have no gizzard, or musculous, but a *membranous* stomach; that kind of food, being torn into small flakes by the beak, may be easily concocted by a *membranous* stomach.
Ray on the Creation.

A *membrane* is a web of several sorts of fibres, interwoven together for the covering and wrapping up some parts: the fibres of the *membranes* give them an elasticity, whereby they can contract, and closely grasp the parts they contain, and their nervous fibres give them an exquisite sense, which is the cause of their contraction; they can, therefore, scarcely suffer the sharpness of medicines, and are difficultly united when wounded. *Quincy.*

Anodyne substances, which take off contractions of the *membranous* parts, are diuretick. *Arbuthnot.*

Birds of prey have *membranaceous*, not muscular stomachs. *Id. on Aliment.*

MEMEL, a fortified town of Prussia, on the Dange, adjacent to the Curische Haff, which here joins the Baltic by a narrow strait, and receives the great river Memel or Niemen, which is navigable through a great part of Lithuania. It has three suburbs, one of which lies beyond the Dange. The situation commands a good regular trade in timber, particular deals, brought down in floats; hemp, flax, corn; hides and skins; tallow, bristles, wax, feathers, and Lithuanian yarn. The imports are chiefly coffee, sugar, pepper, dye-woods, tobacco, rum, and cotton goods. Lying only about thirteen miles from the Russian frontier, this town also carries on a good deal of smuggling with that country. The average number of vessels, great and small, that visit the harbour, is from 600 to 700, of which two-thirds are British. The entrance of the harbour is obstructed by shoals and quicksands, so that it will not admit vessels drawing above eighteen feet of water. The exchange transactions are generally conducted at Konigsberg. The manufactures are trifling, with the exception of the saw-mills for cutting deals, logs, and boards. Population 6000. Seventy miles N. N. E. of Konigsberg, and 130 north-east of Dantzic.

MEMEN'TO, *n. s.* | MEMOIR', | MEM'ORABLE, *adj.* & *n. s.* | MEM'ORABLY, *adv.* | MEM'ORATIVE, *adj.* | MEMORAN'DUM, *n. s.* | MEMO'RIAL, | MEMO'RIALIST, | MEM'ORIZE, *v. a.* | MEM'ORY, *n. s.* } Lat. *memento*, *memorabilis*, *memorandum*, *memorialis*, *memoria* · Fr. *memorie*, *memorable*, *memorial*. Notice, remark, or hint, to assist recollection. A memoir is a collection of such notices; used particularly with regard to personal or family history. Memorably, worthy of being recollected. Memorandum, a note to assist memory. Memorial, as an adjective, assisting memory; retained in memory; (memorative is used by bishop Hall in the former sense): as a substantive, a monument, or other formal record of a person's history, or of particular transactions. A memorialist is the writer, or he who presents a memorial. To memorize is to record; cause to be remembered. Memory, the power or faculty of recollection; fame; time of knowledge.

A *memorial* unto Israel that no stranger offer incense before the Lord. *Num.* xvi. 43.

Nothing I so much delight to recount, as the *memorable* friendship that grew betwixt the two princes.
Sidney.

Churches have names, some as *memorials* of peace, some of wisdom, some in *memory* of the Trinity itself, some of Christ under sundry titles; of the blessed Virgin not a few; many of one apostle, saint, or martyr; many of all. *Hooker.*

They neglect to *memorize* their conquest of the Indians, especially in those times in which the same was supposed. *Spenser.*

When Duncan is asleep, his two chamberlains
Will I with wine and wassel so convince,
That *memory*, the warder of the brain,
Shall be a fume. *Shakspeare. Macbeth.*

That ever living man of *memory*,
Henry the Fifth! *Id. Henry VI.*

Be better suited;
These weeds are *memories* of those worser hours:
I pr'ythee put them off. *Id. King Lear.*

They meant
To *memorize* another Golgotha.
Shakspeare.

Thy master now lies thinking in his bed
Of thee and me, and sighs, and takes my glove,
And gives *memorial* dainty kisses to it. *Id*

Our master, for his learning and piety, is not only a precedent to his own subjects, but to foreign princes; yet he is but a man, and seasonable *mementos* may be useful. *Bacon.*

From this desire, that main desire proceeds,
Which all men have surviving fame to gain,
By tombs, by books, by *memorable* deeds,
For she that this desires doth still remain. *Davies.*

Memorials written with kind Edward's hand shall be the ground of this history. *Hayward.*

Let their names that were bravely lost be rather *memorized* in the full table of time; for my part, I love no ambitious pains in an eloquent description of miseries. *Wotton.*

Do but cast your eyes back upon the fresh *memory* of those late flourishing times of this goodly kingdom, when pure religion was not more cheerfully professed than inviolably maintained. *Bp. Hall.*

The same thoughts do commonly meet us in the same places, as if we had left them there till our return; for that the mind doth secretly frame to itself *memorative* heads, whereby it recals easily the same conceits. *Id.*

Our *memories* are so frail that they need instruments of recollection, and laborious artifices to help them. *Jer. Taylor.*

In other parts like deeds deserved
Memorial, where the might of Gabriel fought.
Milton.

Thy request think now fulfilled, that asked
How first this world, and face of things, began,
And what, before thy *memory*, was done. *Id.*

All the laws of this kingdom have some monuments or *memorials* thereof in writing, yet all of them have not their original in writing; for some of those laws have obtained their force by immemorial usage. *Hale.*

Dares Ulysses for the prize contend,
In sight of what he durst not once defend;
But basely fled that *memorable* day,
When I from Hector's hands redeemed the flaming prey? *Dryden.*

Is not the frequent spectacle of other people's deaths a *memento* sufficient to make you think of your own? *L'Estrange.*

Memory is the power to revive again in our minds those ideas which after imprinting have disappeared, or have been laid aside out of sight. *Locke.*

I resolved to new-pave every street, and entered a *memorandum* in my pocket-book accordingly.
Guardian.

I must not omit a *memorial* setting forth, that the *memorialist* had, with great dispatch, carried a letter from a certain lord to a certain lord. *Spectator.*

As the *memory* relieves the mind in her vacant moments, and fills up the chasm of thought with ideas of what is past, we have other faculties that agitate and employ her upon what is to come. These are the passions of hope and fear. *Id.*

Medals are so many monuments consigned over to eternity, that may last when all other *memorials* of the same age are worn out or lost. *Addison.*

There is not so variable a thing in nature as a lady's head-dress. Within my own *memory* I have known it rise and fall within thirty degrees. *Id.*

Reflect upon a clear, unblotted, acquitting conscience, and feed upon the ineffable comforts of the *memorial* of a conquered temptation. *South.*

Be our great master's future charge
To write his own *memoirs*, and leave his heirs
High schemes of government and plans of wars.
Prior.

The tomb with manly arms and trophies raise;
There high in air *memorial* of my name
Fix the smooth oar, and bid me live to fame. *Pope.*

There is not in any author a computation of the revenues of the Roman empire, and hardly any *memoirs* from whence it might be collected.
Arbuthnot on Coins.

Nature's fair table-book, our tender souls,
We scrawl all o'er with old and empty rules,
Stale *memorandums* of the schools. *Swift.*

May I, at the conclusion of a work, which is a kind of monument of Pope's partiality to me, place the following lines as an inscription *memorial* of it.
Broome.

The case is with the *memorial* possessions of the greatest part of mankind: a few useful things mixed with many trifles fill up their *memoirs*. *Watts.*

He resolved to disappoint the effects of their negociations, by entering into a closer union with his nephew. In order to accomplish this, he transmitted to James an elaborate *memorial*, representing the numerous encroachments of the see of Rome upon the rights of sovereigns.
Robertson. History of Scotland.

Excesses of all kinds do a great injury to the *memory*. *Mason.*

They spake of him they loved, of him whose life,
Though blameless, had incurred perpetual strife;
Whose deeds had left, in spite of hostile arts,
A deep *memorial* graven on their hearts. *Cowper.*

Theresa's form—
Methinks it glides before me now,
Between me and yon chesnut's bough,
The *memory* is so quick and warm;
And yet I find no words to tell
The shape of her I loved so well. *Byron.*

MEMMINGEN, a walled town of Bavaria, on the Iller, has a neat town-house, a merchants' hall, arsenal, barracks, a public library, and a high school. Its manufactures are on a small scale, and consist of the weaving and printing cottons and linen, tanneries, tobacco, woollen, iron and copper works. In the environs hops are cultivated. Population 6500, chiefly Lutherans. Twenty-eight miles south by east of Ulm.

MEMNON, in fabulous history, a king of Ethiopia, son of Tithonus and Aurora. He came with a body of 10,000 men to assist his uncle Priam during the Trojan war. He behaved with great courage, and killed Antilochus, Nestor's son. The aged father challenged the Ethiopian monarch; but Memnon refused it on account of the venerable age of Nestor, and accepted that of Achilles. He was killed in the combat, in the sight of the Grecian and Trojan armies. Aurora prayed Jupiter to grant her son such honors as might distinguish him from other mortals. The god consented; and immediately a numerous flight of birds issued from the burning pile on which the body was laid, and dividing themselves into two separate bodies, fought with such fury, that above half of them fell in the fire as victims to appease the manes of Memnon. These birds were called Memnonides: and it has been said, by some of the credulous ancients, that they never failed to return every year to the tomb of Memnon in Troas, and repeat the same bloody engagement in honor of that hero. The Ethiopians or Egyptians, over whom Memnon reigned, erected a celebrated statue to his memory. This statue had the wonderful property of uttering a melodious sound every day at sun-rising, like that which was heard at the breaking of the string of a harp when it was wound up: effected, it is

said by the rays of the sun, when they fell upon it. At the setting of the sun, and in the night, the sound was lugubrious. Such is the testimony of the geographer Strabo, who confesses himself ignorant, however, whether the sound proceeded from the basis of the statue, or the people that were then around it. This celebrated statue was dismantled by order of Cambyses when he conquered Egypt: but its ruins still astonish modern travellers by their grandeur and beauty.

MEMNON OF RHODES, one of the generals of Darius king of Persia. He advised that prince to lay waste the country, in order to deprive Alexander the Great's army of support, and afterwards to attack Macedon; but this counsel was disapproved by Darius's other generals. Memnon behaved, at the passage of the Granicus, like an experienced general. He afterwards defended the city of Miletum with great courage; seized the islands of Chio and Lesbos: spread terror throughout all Greece; but was stopped in his progress by the hand of death. Barsina, Memnon's widow, was taken prisoner with Darius's wife, and Alexander had a son by her named Hercules.

MEMORY is that faculty of the mind which presents to us ideas of what is past, accompanied with a persuasion, that the things themselves were formerly real and present. What we distinctly remember to have perceived, we as firmly believe to have happened, as what is now present to our senses. The means by which the mind retains the ideas of past objects, and how these ideas carry with them evidence of their objects having been actually perceived, will be found noticed in our article METAPHYSICS. The ingenious Dr. Beattie, in his Elements of Moral Science, divides memory into two species, active and passive.' 'When we remember,' says he, 'with little or no effort, it is called remembrance simply, or memory, and sometimes passive memory. When we endeavour to remember what does not immediately, and, as it were, of itself, occur, it is called active memory, or recollection.' This is a talent of importance in every situation of life, and many rules have been laid down for its acquisition, direction, improvement, and preservation. Perhaps the most important practical observation on the subject is, that sensual excess of any kind is prejudicial to the brain, and gradually impairs this faculty. Such, indeed, is the precarious state of our mental powers, and particularly of our recollection, that it often happens, even with the most regular and temperate, that, notwithstanding every effort, those ideas, which appear to be the most interesting and desirable to be retained, vanish from the mind irrecoverably. To correct this inherent weakness various methods have been proposed, which constitute what is called the art of memory. Those of our readers who are inclined to avail themselves of such assistance, may consult Dr. Gray's treatise, entitled A New Method of Artificial Memory, or our article MNEUMONICS. But let them remember that it is not extraneous aid, but constant attention and exercise, which form the true art of memory. 'It is the practice of many readers,' says Dr. Beattie, 'to note in the margin of their books the most important passages, the strongest arguments, or the brightest sentiments. Thus they load their minds with superfluous attention, repress the vehemence of curiosity by useless deliberations, and by frequent interruption break the current of narration or the chain of reason, and at last close the volume, and forget the passages and the marks together. Others are firmly persuaded, that nothing is certainly remembered but what is transcribed: and they, therefore, pass weeks and months in transferring large quotations to a common-place-book. Yet, why any part of a book, which can be consulted at pleasure, should be copied, we are not able to discover. The hand has no closer correspondence with the memory than the eye. The act of writing itself distracts the thoughts; and what is read twice is commonly better remembered than what is transcribed. This method, therefore, consumes time, without assisting the memory. But to write an abridgment of a good book may sometimes, be a very profitable exercise. In general, when we would preserve the doctrines, sentiments, or facts, that occur in reading, it will be prudent to lay the book aside and put them in writing in our own words. This practice will give accuracy to our knowledge, accustom us to recollection, improve us in the use of language, and enable us so thoroughly to comprehend the thoughts of other men, as to make them in some measure our own.' 'Our thoughts,' says the author of the Idler, 'have, for the most part, a connexion; so that the thought which is just now in the mind, depends partly upon that which went before, and partly serves to introduce that which follows. Hence we remember best those things of which the parts are methodically disposed and mutually connected. A regular discourse makes a more lasting impression upon the hearer than a parcel of detached sentences, and gives to his rational powers a more salutary exercise: and this may show us the propriety of conducting our studies, and all our affairs, according to a regular plan or method. When this is not done, our thoughts and our business, especially if in any degree complex, soon run into confusion.' It is hardly credible to what a degree both active and passive memory may be improved by long practice. Scaliger reports, of himself, that in his youth he could repeat above 100 verses, having once read them; and Berthicus declares that he wrote his Comment upon Claudian without consulting the text. The extraordinary memory of Magliabechi is well known. See MAGLIABECHI. That of Jedidiah Buxton was of a peculiar kind, so long habituated to numbers, that it could fix on nothing else. See BUXTON. To hope, however, for such degrees of memory as these, would be equally vain as to hope for the strength of Hercules, or the swiftness of Achilles. 'But there are clergymen,' says Dr. Johnson, 'who can get a sermon by heart in two hours, though their memory, when they began to exercise it, was rather weak than strong. And pleaders, with other orators who speak in public and extempore, often discover, in calling instantly to mind all the knowledge necessary on the present occasion, and every thing of importance that may

have been advanced in the course of a long debate, such powers of retention and recollection as, to the man who has never been obliged to exert himself in the same manner, are altogether astonishing. As habits, in order to be strong, must be formed in early life, the memories of children should therefore be constantly exercised; but to oblige them to commit to memory what they do not understand, perverts their faculties, and gives them a dislike to learning.' In a word, those who have most occasion for memory, as orators and public speakers, should not suffer it to lie idle, but constantly employ it in treasuring up and frequently reviving such things as may be of most importance to them; for, by these means it will be more at their command, and they may place greater confidence in it upon any emergency.'

MEMPHIS, an ancient city, and the royal residence of the kings in Upper Egypt; fifteen miles from Delta to the south, according to Pliny: called also Moph and Noph, in Scripture. Though this city is now so completely ruined that authors greatly disagree concerning its situation, yet Strabo says, that in his time it was the most magnificent in Egypt, next to Alexandria. It was the capital of the country: and there was an entire temple of Osiris, where the Apis, or sacred ox, was kept and worshipped; with an apartment for the mother of the ox; a very magnificent temple of Vulcan; a large circus for fighting bulls; and a great colossus in the middle of the city, which was thrown down. There was likewise a temple of Venus, and a serapium in a very sandy place, where the wind heaps up hills of sand very dangerous to travellers; with a number of sphynxes, the heads of some of them only being visible, the others covered up to the middle with sand. He adds, that in the front of the city there were many lakes; and that it contained a number of palaces, at that time in ruins. These buildings, he said, formerly stood upon an eminence; they lay along the side of the hill, stretching down to the lakes and groves, forty stadia from the city. There was likewise a mountain in the neighbourhood, on which were a great number of pyramids, with the sepulchres of the kings, among which two were accounted wonders of the world. From this description, Mr. Bruce concludes, that the celebrated capital of Egypt stood in the place where the villages of Metrahenny are now situated; in opposition to Dr. Shaw's opinion, who thinks it was situated at Geeza, Gisa, or Gyzeh. Savary has also shown, that Gisa was not the situation of the ancient Memphis.. This stood, he says, on the west bank of the Nile, on the spot where the village of Memph now stands, which still preserves the name. Large heaps of rubbish are still to be seen there; but the Arabs have transported to Cairo the columns and remarkable stones, which they have disposed, without taste and without order, in their mosques and public buildings. This city extended as far as Saccara; and was almost wholly encompassed by lakes, part of which are still subsisting. It was necessary to cross them to convey the dead to the sepulchres. The tombs, hewn out of the rock, were closed up with stones of a proportionable size, and covered with sand. These bodies, embalmed with so much care, and preserved with so much respect, are torn from the monuments they repose in, and sold without decency to strangers, by the inhabitants of Saccara. This place is called the plain of mummies. There too we find the well of the birds, into which one descends by a rope, into subterraneous galleries, filled with earthen vases, containing the sacred birds. They are rarely met with entire, because the Arabs break them in hopes of finding idols of gold. They do not conduct travellers into the places where they have found more precious articles. They even close them up carefully, reserving to themselves some secret passages by which they descend. In a journey into Egypt, made by the duke de Chaulnes, he advanced very far into these winding labyrinths, sometimes crawling, and sometimets scrambling on his knes. Informed by Mr. Edward Wortley Montague, who had carefully visited Egypt, he arrived at one of those passages which had an opening shut up from without, by branches of the date tree interwoven, and covered with sand. He remarked there some hieroglyphics in relievo, executed in the highest perfection. But the Arabs resisted every offer he made them to permit him to take drawings or moulds of them. The duke is of opinion that these hieroglyphics, sculptured with so much art that the objects they represent may be discovered at the first sight, might furnish the key of the others, whose contours are simply expressed, and form a sort of alphabet of this unintelligible language. Several pyramids are distinguishable along the mountains which bound Saccara on the west, the greatest part of which appear as lofty as those of Gisa. See PYRAMIDS.

MEMPHREMAGOG, a lake of North America, the greater part of which belongs to Canada, and the rest to the state of Vermont. It is thirty-five miles long, and three broad; in long. 72° 8′ W., lat. 45° N. It communicates with the St. Lawrence, by the river St. Francis, and receives the waters of Black, Barton, and Clyde rivers, which rise in Vermont.

MEN'ACE, *v. a.* & *n. s.* } Fr. *menacer, me-*
MEN'ACER. } *nace;* Lat *minatio,* à *minâ*, a weight. To threaten; a threat: a menacer is one who threatens.

Who ever knew the heavens menace so?
Shakspeare.

From this league
Peeped harms that *menaced* him. *Id.*

How many of us, after a thousand hammerings of the *menaces* of God's law upon our guilty souls, continue yet insensible of our danger! *Bp. Hall.*

Purely to seek God's honour, and in all our actions to regard it as our principal aim—promiseth the best rewards to humility, and *menaceth,* that whoever exalteth himself shall be abased. *Barrow.*

He that would not believe the *menace* of God at first, it may be doubted whether, before an ocular example, he believed the curse at last.
Browne's Vulgar Errours.

What should he do? 'Twas death to go away,
And the god *menaced* if he dared to stay. *Dryden*

Hence, *menacer!* nor tempt me into rage:
This roof protects thy rashness. But begone!
Philips.

MENAGE', *n. s.* Fr. *menage.* A collection of animals.

The horse is a noble creature: which, as it is the strength and pride of France, so wins the hearts and heels of that nation. And whereas there is a double kind of *menage*, as I have heard, one for service, the other for pleasure. *Bp. Hall.*

I saw here the largest *menage* that I ever met with. *Addison.*

Menage (Giles), a celebrated French writer, born at Angers in 1613. He finished his studies in that city, was made advocate, and pleaded, for some time, at Angers, Paris, and Poictiers; but at length became an ecclesiastic, and studied polite literature. He entered into the family of cardinal de Retz, and afterwards went to live in the cloister of Notre Dame, where he held a weekly assembly of learned men. He read a great deal, and was incessantly quoting in his conversation verses in Greek, Latin, Italian, French, &c., on which account he was ridiculed as a pedant. The reputation of his works procured him a place in the academy della Crusca, at Florence. His Requeste des Dictionaires, with the superior interest of his competitor Mr. Bergent, prevented his admission into the French Academy. He died at Paris in 1692, aged seventy-nine. He published many books in prose and verse; the principle are, 1. Miscellaneous Works. 2. The Origin of the French Language. 3. The Origin of the Italian Tongue; Geneva, 1685, folio. 4. Malherbe's Poems, with Notes. 5. Diogenes Laertius, with Observations. 6. Remarks on the French Tongue. 7. Greek, Latin, Italian, and French Poems.

MENAI Strait, and Bridge. Menai Strait is a strait about half a mile across, between the island of Anglesey and the coast of Wales, which has become of considerable importance in modern times as a point of communication between Great Britain and Ireland. The mail from London to Dublin passes this strait regularly: a circumstance which, in the year 1810, induced the house of commons to appoint a select committee 'to enquire into the state of the roads from Holyhead to London; into the regulations for the conveyance of his majesty's mail between London and Dublin; and also into the laws and regulations relating to the conveyance of passengers, goods, and merchandise, between Dublin and Holyhead.' This committee made several reports, in which it recommended various measures for improving the roads in this great line of communication, many of which are now in progress. But, in regard to expedition, it would have been of little avail to have improved the roads, without remedying the delay, the inconvenience, and the danger, experienced in crossing the Menai Strait.

In this year and 1811, therefore, several plans of Bridges were proposed for effecting a regular and unobstructed passage in the place of the Bangor ferry. All the bridges proposed were to be of cast iron, and of sufficient width of span and height of elevation not to obstruct the navigation. Among those approved by the committee of the house of commons, after due investigation, was one of a single arch, of cast iron, of 500 feet span, and 100 feet above the level of high-water in the middle of the arch, projected by Mr. Telford. Although the least expensive of any cast iron bridge of those dimensions, the estimated cost of this bridge was upwards of £127,000. But the construction of such a bridge presented a difficulty in the fixing of proper centering, which could not be accomplished by ordinary means from below, owing to the rocky bottom of the channel, and the depth and rapidity of the tide-way. Mr. Telford was, however, led to devise a new mode of suspending the centering from above, and furnished a design of this kind.

The report of the commissioners being made to parliament, and the necessary funds being granted, in July 1818 directions were given for the commencement of the work, at Ynysy-moch, on the Anglesey shore. It was to consist of one opening of 560 feet between the points of suspension, and 100 feet in height between the high-water line and the lower side of the road-way; and, the road-way being horizontal, this height to be uninterrupted for the whole 560 feet, except where the natural rock, which forms the western abutment, interposes. In addition to these 560 feet, there were to be four arches on the western, and three on the eastern side of the main opening, each fifty feet in span, that is, making in all 850 feet of opening. The road way to consist of two carriage-ways, each twelve feet in breadth, with a foot-path of four feet between them; and the whole to be suspended from four lines of strong iron cables by perpendicular iron rods, placed five feet apart. The suspending power was calculated at 2016 tons, and the weight to be suspended, exclusive of the cables, at 342 tons, leaving a disposable power of 1674 tons. The estimated expense was £70,000.

In will be seen, in our articles Anglesey and Beaumaris, that this noble undertaking has been successfully accomplished; we only reserve some remarks upon its scientific structure to the general article Suspension Bridges.

MENANCABOW, an entire state or empire of the island of Sumatra, situated under the equator. It formerly extended over the whole island; but has been on the decline ever since Sumatra was first visited by European navigators. In more modern times its limits have been included between the river Palembang and that of Siak on the eastern side of the island; and, on the western side, between those of Manjuta (near Indrapur) and Singkel, where it borders on the country of the Battas. The present seat, or more properly seats, of the divided government, lie at the back of the Tiga-blas koto district. The country is chiefly one large plain, surrounded by hills producing gold, and comparatively well cultivated. Its communication with the eastern side of the island is facilitated by means of a large lake, described by some traders as equal to a day's sailing, and by others as about the length of from twenty-five to thirty miles. From this lake a river flows east, and the banks are well peopled by Malay colonies. The arts are here carried to a greater degree of perfection than in any other part of Sumatra: these Malays being the sole fabricators of the

exquisite gold and silver filagree of this part of the world. In this country also they have, from the earliest times, manufactured arms for their own use, and that of the northern inhabitants of the island: they even harden their own steel. The use of cannon in this and other parts of India is mentioned by the oldest Portuguese historians. Their guns are match-locks, springs and flints not having been adopted by them. The barrels are of excellent materials, and of the justest bore. The inhabitants are said always to take aim by lowering, instead of raising, the muzzle of the piece. They have other weapons of the sword and spear kind; and a species of dagger, called a kris, is very generally worn. In the government the sultan or rajah is despotic; but his power is modified by the influence of the aristocracy: and the people are feudal serfs.

MENANDER, an ancient Greek poet, born at Athens in the third year of the 109th Olympiad. His introducing the new comedy, and refining an art which had been so gross and licentious in former times, quickly spread his name over the world. Pliny says that the kings of Egypt and Macedon sent ambassadors and fleets to bring him to their courts, but without success. Of his works, which amounted to above 100 comedies, only nine are left besides the four which Terence borrowed from him. It is chiefly from Terence that most people form their judgment of Menander, the fragments that remain of him not being sufficient to enable them to do it. Quintilian, and other old masters of rhetoric, recommend his works as true patterns of every beauty and grace in public speaking. Cæsar calls Terence only a semi Menander. Menander died in the third year of the 122d Olympiad. His tomb, in the times of Pausanias, was to be seen at Athens, in the way from the Piræus to the city, close by the monument of Euripides.

MENANDER, the founder of a sect called Menandrians. Some say he was a disciple of Simon Magus. He taught that no person could be saved unless he were baptised in his name; and he conferred a peculiar sort of baptism, which would render those who received it immortal in the next world; exhibiting himself to the world, with the phrenzy of a lunatic, as a promised saviour. Irenæus, Justin, and Tertullian say, that he pretended to be one of the æons sent from the pleroma, or ecclesiastical regions, to succour the souls that lay groaning under bodily oppression; and to maintain them against the violence and stratagems of the dæmons that hold the reins of empire in this sublunary world.

MENASSEH BEN ISRAEL, a celebrated rabbi, born in Portugal about 1604. He was the son of Joseph Ben Israel, and followed his father into Holland; where he was educated by rabbi Isaac Uzziel, under whom he made such progress in the Hebrew tongue, that, at eighteen years of age, he succeeded him in the synagogue of Amsterdam. In this post he continued several years, and married Rachel of the Abarbanel family, whom the Jews affirm to be descended from king David. He afterwards went to his brother Ephraim, a rich merchant at Basil; by whose advice he entered into trade. Some time after he came into England, then under the protectorship of Cromwell, who gave him a very favorable reception, and one day entertained him at his table with several other learned divines. However he soon after passed into Zealand; and died at Middleburg about 1659. The Jews at Amsterdam buried him at their own expense. He was a Pharisee, had a lively wit, a solid judgment, and great learning. He wrote many books in Hebrew, Latin, Spanish, and English. The principal of those published in Latin are, 1. His Conciliator; a learned and curious work, in which he reconciles those passages of Scripture which seem to contradict each other. 2. De Resurrectione Mortuorum. 3. De Termino Vitæ. 4. Dissertatio de Fragilitate Humanâ, ex lapsu Adami, deque Divino in bono opere Auxilio. 3. Spes Israel. Dr. Thomas Pococke wrote his life in English.

MENCKE, or MENCKENIUS (Lewis Otto), a learned professer of morality at Leipsic, born at Oldenburg in Westphalia in 1644. He studied in several universities of Germany; and became an able philosopher, civilian, and divine. He was made professor of morality at Leipsic in 1668, and enjoyed that post till his death. He was five times rector of the university of that city, and seven times dean of the faculty of philosophy. He published several works, but his most considerable, and which alone is sufficient to perpetuate his memory, is the Acta Eruditorum, of Leipsic, of which he was the first author, and in which he was engaged till his death. The first volume was published at Leipsic, in 4to., in 1682. He died in 1707, aged sixty-three.

MENCKE, or MENCKENIUS (John Burchard), son to the preceding. After his studies he travelled into England and Holland; and, upon his return, was appointed professor of history at Leipsic, in 1688. He gained great reputation by his lectures, as well as his writings. He wrote many pieces, particularly De Charlataneria Eruditorum Declamationes duæ; an excellent satire on false scholars. 2. Methode pour Etudier l'Histoire, avec un Catalogue des Principaux Historiens, &c. 3. A Continuation of the Acta Eruditorum. He made many additions to Mr. Lenglet's book, especially with regard to the German historians. He died in 1732, aged fifty-eight.

MEND, *v. a.* & *n. s.* } Lat. *emendo*, from *men-*
MEND'ER, *n. s.* } *da*, a fault. To repair a fault or breach; correct; meliorate; help; improve; increase; grow better.

They gave the money to the workmen to repair and *mend* the house. 2 *Chron.* xxxiv. 10.

What trade art thou? A trade that I may use with a safe conscience; a *mender* of bad soles.
Shakspeare. Julius Cæsar.

Whatever is new is unlooked for; and ever it *mends* some, and impairs others: and he that is holpen takes it for a fortune, and he that is hurt for a wrong.
Bacon.

Death comes not at call; justice divine
Mends not her slowest pace, for prayer, or cries.
Milton.

The best service they could do to the state, was to *mend* the lives of the persons who composed it.
Temple.


MICKLE.
MENANDER.
METASTASIO.
MERCATOR.
MERULA.
MERCURIALIS.
MENGS.
MEZERAI.
MEURSIUS.

When upon the sands the traveller
Sees the high sea come rolling from afar,
The land grow short, he *mends* his weary pace,
While death behind him covers all the place.
Dryden.

If, to avoid succession in eternal existence, they recur to the punctum stans of the schools, they will thereby very little *mend* the matter, or help us to a more positive idea of infinite duration. *Locke.*

Though in some lands the grass is but short, yet it *mends* garden herbs and fruit. *Mortimer's Husbandry.*

Name a new play and he's the poet's friend;
Nay, showed his faults—but when would poets *mend*?
Pope.

Their opinion of Wood, and his project, is not *mended*. *Swift.*

Happy the bard (if that fair name belong
To him that blends no fable with his song)
Whose lines uniting, by an honest art,
The faithful monitor's and poet's part,
Seek to delight, that they may *mend* mankind,
And, while they captivate, inform the mind.
Cowper.

MENDACITY, *n. s.* Lat. *mendax*. Falsehood.

In this delivery there were additional *mendacities*; for the commandment forbid not to touch the fruit, and positively said, Ye shall surely die; but she, extenuating, replied, Lest ye die. *Browne.*

MENDE, Auderitum, a very ancient town, and the principal place of the department of Lozère, in France. It has an inferior court of justice, under the jurisdiction of the royal court of Nîmes; a board of manufactures; a society of agriculture, and of arts and sciences; and a communal college. It is a post town, containing about 5500 inhabitants. This town is situated in the bottom of a delightful valley on the left bank of the river Lot, surrounded by mountains, from which descend numerous streams that water a great number of gardens and country seats in the neighbourhood. It is surrounded with a little boulevard, and is pretty well built; the streets, however, are narrow, but several public fountains contribute much to its cleanliness, and the freshness of its air. Among its manufactures may be particularly mentioned coarse cloth, serges, &c. A considerable trade is carried on in these articles, which are exported into Spain, Italy, Germany, and the interior of France. Here are a public library containing 6500 volumes, and a gallery of pictures. The cathedral is remarkable for its loftiness, and the bold architecture of its towers. The public fountain of the Griffon is particularly beautiful, and at a little distance from the town is the hermitage of St. Privast. Mende is situated fifty-seven miles distant south-east from St. Flour; sixty S.S.W. from Puy; ninety-three north from Montpelier, and 414 south from Paris.

MENDELSHON (Moses), or Moses the son of Mendal, a Jew of Berlin, and one of the most celebrated writers in Germany, born in 1728. His first attempt as an author was in 1755, by a work entitled Jerusalem; in which, besides other unjustifiable opinions, he maintains, that the Jews have a revealed law, but not a revealed religion; that opinions are not subjects of revelation; and that the only religion of the Jews is that of nature. He acquired great honor by his Phedon, or a Discourse on the Immateriality and Immortality of the Soul, translated into French in 1773; and was styled the Jewish Socrates by some periodical writers. His modest and obliging disposition gained him the esteem equally of the superstitious and of the incredulous. At his death he received from his nation those honors which are paid to their first rabbis. He greatly recommended himself by his integrity in business; but philosophy and literature were his principal occupation. His weak constitution being gradually impaired by intense application to study, he died in 1785, aged fifty-seven.

MENDEZ PINTO (Ferdinand), was born at Montemoro Velho, in Portugal. He embarked for India in 1537. His vessel being taken by the Turks, on his passage, he was carried to Mocra, and sold to a Greek renegado, and afterwards to a Jew; in whose possession he continued till he was redeemed by the governor of Ormus, a Portuguese fort; who procured him an opportunity of going out to India. During a residence of twenty-one years in that country, he was witness to very important transactions, and experienced many singular adventures. He returned to Portugal in 1558, where he enjoyed the reward of his labors, after having been thirteen times a slave, and sixteen times sold. A very curious account of his travels was written by himself, and published at Lisbon, A.D. 1614 in folio. It was translated into French by Bern Figuier, and printed at Paris, 1645, in 4to. It elucidates various particulars relating to the geography, history, and manners of the inhabitants of China, Japan, Pegu, Siam, Achem, Java, &c.

MEN'DICANT, *adj.* & *n. s.* Fr. *mendicant*; Lat. *mendicans*, *mendico*. Begging; poor to beggary: a beggar; one of the fraternity of beggars in the Romish church.

I am no whit afraid, O ye rich citizens, lest this paradox of our holy *mendicants* shall make you out of love with your wealth: I fear some of you would be rich though ye might not. *Bp. Hall.*

There is surely a physiognomy which master *mendicants* observe; whereby they instantly discover a merciful aspect, and will single out a face wherein they spy the signatures and marks of mercy.
Browne.

Be not righteous over much, is applicable to those who, out of an excess of zeal, practise mortifications, whereby they macerate their bodies; or to those who voluntarily reduce themselves to a poor and *mendicant* state. *Fiddes.*

What is station high?
'Tis a proud *mendicant*; it boasts and begs;
It begs an alms of homage from the throng,
And oft' the throng denies its charity. *Young.*

Digression is so much in modern use,
Thought is so rare, and fancy so profuse,
Some never seem so wide of their intent,
As when returning to the theme they meant;
As *mendicants*, whose business is to roam,
Make every parish but their own their home.
Cowper.

MENDICANTS, or begging friars, several orders of religious in Popish countries, who, having no settled revenues, are supported by the charitable contributions they receive from others. This class of society began in the thirteenth century, under Innocent III., who encouraged them as well as his successors. The members, by the

tenor of their institution, were to remain entirely destitute of all fixed revenues and possessions. But they at last increased to such an enormous multitude, that they became a burden not only to the people, but to the church itself. In a general council, therefore, assembled by Gregory X. at Lyons, in 1272, the mendicants were reduced to a smaller number, and confined to the four following societies, viz. the DOMINICANS, the FRANCISCANS, the CARMELITES, and the AUGUSTINES. (See these articles.) As the pontiffs allowed these four mendicant orders the liberty of travelling wherever they thought proper, of conversing with persons of every rank, of instructing the people wherever they went; and as those monks exhibited, in their manner of life, more striking marks of gravity and holiness than the other monastic societies, they arose to the summit of fame, and were regarded with the utmost veneration through all Europe. They were employed, not only in spiritual matters, but also in temporal and political affairs of the greatest consequence, in composing the differences of princes, concluding treaties of peace, concerting alliances, presiding in cabinet councils, governing courts, levying taxes, and other occupations, absolutely inconsistent with the monastic character and profession. However, the power of the Dominicans and Franciscans greatly surpassed that of the other two orders; insomuch that they were, before the Reformation, what the Jesuits have been since, the very soul of the hierarchy. At last their pride and confidence arrived at such a pitch, that they had the presumption to declare, that they had a divine commission to illustrate and maintain the religion of Jesus; that the true method of obtaining salvation was revealed to them alone; proclaiming the superior efficacy of their indulgences, and boasting their interest with the Supreme Being, the Virgin Mary, and the saints. By these impious wiles they so deluded the blinded multitude, that they would not entrust any but the mendicants with the care of their souls. Towards the close of the fourteenth century great numbers of both sexes requested admission into the order, as an infallible method of rendering heaven propitious. Many made it an essential part of their last wills, that their bodies after death should be wrapped in old ragged Dominican or Franciscan habits, and interred among the mendicants, to insure the divine mercy. But about the commencement of the fifteenth century they became the objects of general odium. Being, however, protected against all opposition by the popes, who regarded them as their most effectual supports, they suffered little from their numerous adversaries. Besides their arrogance, which was excessive, a quarrelsome and litigious spirit prevailed among them, and drew upon them justly the indignation of many. By affording refuge to the Beguines in their order they offended the bishops, and were thereby involved in difficulties of various kinds. They lost their credit in the sixteenth century by their rustic impudence, their ridiculous superstitions, their ignorance, cruelty, and brutish manners. They discovered the most barbarous aversion to the sciences, and to learned men, who endeavoured to open the paths of science to the pursuits of the studious youth, recommended the culture of the mind, and attacked the barbarism of the age in their writings and discourses. Their general character concurred with other circumstances to render a reformation desirable, and to accomplish this happy event. Among the number of Mendicants are also ranked the Capuchins, Recollects, Minims, and other branches from them. Buchanan tells us, the mendicants in Scotland, under an appearance of beggary, lived a very luxurious life; whence one wittily called them, not Mendicant but Manducant friars.

MENDOZA (Gonzales Peter de), a Spanish cardinal, born in 1428. He was an eminent statesman, and obtained the hat from Sixtus IV. He translated Homer and Virgil into Spanish, and died in 1495.

MENDOZA (John Gonzales de), an Augustine friar of Castile, who was ambassador from the king of Spain to the emperor of China. In 1593 he was made bishop of Lipari in Italy; in 1607 of Chiapa in New Spain; and in 1608 of Papaian in the West Indies. He wrote a history of China in Spanish, which has been translated into several languages.

MENDOZA, a city of Buenos Ayres, in the province of Cuyo, at the foot of the Andes. The neighbourhood is full of plantations watered by canals. It contains four convents, a Jesuits' college, and a church. A silver mine having been lately opened in its vicinity, the number of inhabitants is increasing, and at present amount to about 6000, employed in these works, or in carrying on a productive trade in fruits, wool, and wine. The river Mendoza flows by this town, which is fifty leagues from Santiago in Chili, and the district contains two silver, one copper, and one lead mine. Long. 69° 47 W., lat. 33° 25′ S.

MENDOZA, a large river of Buenos Ayres, in the province of Cuyo, which rises in the eastern slope of the Andes, and, running east, is formed into lakes in the plains; whence it issues under the name of Desaguero, and finally enters the Atlantic under the name of Colorado.

MENDRAH, a district and town of Fezzan, in Africa, with a soil generally hard and barren; but the quantity of trona, a species of fossil alkali, used in Morocco as an ingredient in the red dye of the leather, settles on the banks of numerous smoky lakes, and gives it a commercial importance. Great quantities of it are brought by the Fezzan merchants and shipped at Tripoli.

MENDS. For AMENDS, which see.

Let her be as she is: If she be fair, 'tis the better for her: and if she be not, she has the *mends* in her own hands. *Shakspeare.*

MENECRATES, a physician of Syracuse, who flourished about A. A. C. 360, famous for his skill in his profession, but much more for his vanity. He affected the character and attributes of Jupiter; made his patients follow him in those of the other gods, and travelled through different countries, escorted by these counterfeit deities. He once wrote to the king of Macedon, 'Menecrates Jupiter to Philip, greeting. Thou reignest in

Macedonia, and I in medicine; thou givest death to those who are in good health, I restore life to the sick; thy guard is composed of Macedonians; the gods themselves constitute mine.' Philip answered that he wished him restored to reason. Hearing afterwards that he was in Macedon, Philip sent for him, and invited him to an entertainment. Menecrates and his companions were placed on rich and lofty couches; before which was an altar, covered with the first fruits of the harvest: and, whilst an excellent repast was served up to the other guests, perfumes and libations only were offered to these new gods, who, greatly affronted, hastily left the palace, and never returned.

MENEDEMUS, a Greek philosopher, born at Erythreum, was the son of Callisthenes, and one of Phedo's followers. He was in the greatest esteem, and enjoyed several important posts in his own country. He several times defended Erythreum with great bravery, and died of grief when Antigonus conquered it. He flourished about 300 B. C.

MENELAUS, the son of Atreus, and brother of Agamemnon, reigned at Sparta, when Paris deprived him of his wife Helen. This rape occasioned the famous war of Troy. See Helen, and Paris.

Menelaus, a mathematician in the reign of Trajan, who wrote three books on the Sphere, which have been published by Marsenne.

MENES, the founder of the Egyptian monarchy, was born at This, a town of Thebias, in Upper Egypt. He had three sons, viz. Athotis, who ruled after him at This and Thebes; Curudes, who in Lower Egypt founded the kingdom of Heliopolis, which was afterwards that of Diospolis; and Necherophes, who reigned at Memphis. It is supposed that Menes reigned 117 years after the birth of Peleg, son of Heber, which was the year of the dispersion of mankind throughout the earth. In building Memphis he stopped the Nile near it, by a causeway 100 furlongs broad, and caused it to run through the mountains. Sir Isaac Newton makes Menes the same with Amenophis. See Ethiopia. Others make him the same with Mizraim.

MENESTRIER (John Baptist le), a native of Dijon, one of the most learned French antiquaries of his time. He wrote, 1. A Treatise on the medals, money, and ancient monuments of the Roman Empresses, in folio: 2. The most famous medals of the ancient Roman emperors and empresses in 4to. He died in 1634, aged seventy.

MENGS (Anthony Raphael), first painter to the king of Spain, was born at Auing in Bohemia, A. D. 1728. His father, painter to Augustus III. king of Poland, perceiving his superior talents, carried him from Dresden to Rome in 1741. Having copied the principal monuments of that capital, he returned in 1744 to Dresden, where he executed different works for Augustus with great success. During his stay in Italy he became acquainted with Charles, king of Naples; who, when he succeeded to the crown of Spain in 1761, engaged Mengs in his service, by granting him a pension of 2000 doubloons, with a house and equipage. He lived, however, chiefly at Rome; where, in 1779, he fell a sacrifice to his confidence in a German quack, who pretended to cure him of a disease which he had contracted, partly by intense application, and partly by grief for the loss of his wife. His manners were simple; he was a fond husband and a kind father; but his faults were want of economy and unbounded generosity. Although he received during the last eighteen years of his life above 250,000 livres, he hardly left wherewithal to defray his funeral charges. The king of Spain adopted his five daughters, and granted pensions to his two sons. His chief paintings are at Madrid and at Rome. A catalogue of them is to be found in the account of his life prefixed to his works, in 2 vols. 4to., published at Parma in 1780 by Chevalier d'Azara. These contain, 1. Reflections on the Beautiful, and on Taste in Painting. 2. Reflections on Raphael, Correggio, Titian, &c. 3.. On the cultivation of the Fine Arts in Spain. 4. Two Letters on the Group of Niobe. 5. A Letter on the Origin, Progress, &c., of Drawing. 6. A Letter on the principal Paintings at Madrid. 7. Memoirs of Correggio. 8. Memoirs of the Academy of Fine Arts at Madrid. 9. Practical Lessons in Painting. He formed his style upon the different excellencies of Raphael, Correggio, and Titian.

ME'NIAL, *adj.* & *n. s.* From Meiny, which see. Belonging to a retinue or train of servants: a servant of low order.

Two *menial* dogs before their master pressed;
Thus clad, and guarded thus, he seeks his kingly guest. *Dryden's Æneid.*

Hard is the fate of the infirm and poor!
Here, as I craved a morsel of their bread,
A pampered *menial* drove me from the door,
To seek a shelter in a humble shed. *Moss.*

The women attendants perform only the most *menial* offices. *Gulliver's Travels.*

MENIN, a handsome fortified town of Flanders, seated on the small river Lys. It has often changed masters; having been taken by the French in 1667, and fortified very strongly by Vauban; retaken by the allies in 1706, and ceded to the house of Austria by the treaty of Utrecht, but recovered in 1744 by the French, who demolished its fortifications. It was restored to Austria by the treaty of Aix-la-Chapelle; but was taken by the French republicans under Pichegru, April 30th, 1794, and annexed to France in 1795. It is well built, and its four principal streets, terminated by as many gates, meet in a square. Here are manufactures of lace, table linen, and silk stuffs; oil, soap, and tobacco. The bleaching fields are extensive, and it has two well attended annual fairs. Population 4600. It is eleven miles north of Lisle, and thirty south of Bruges.

MENIN'GES, *n. s.* Gr. μενιγγος. The two membranes that envelop the brain, and which are otherwise called the pia mater and dura mater.

The brain, being exposed to the air, groweth fluid, and is thrust forth by the contraction of the *meninges.* *Wiseman.*

MENINSKI, or Menin (Francis), or Francis à Mesgnien, a learned orientalist, born in Lorrain in 1623. He travelled to the east, and for

his skill in the oriental languages was made interpreter and counsellor of war to the emperor of Germany. He wrote a dictionary, entitled Thesaurus Linguarum Orientalium, printed at Vienna in 5 vols. folio, 1680 and 1687. He died at Vienna in 1698.

MENIPPEAN SATIRE, MENIPPEA SATIRA, a kind of satire consisting of prose and verse intermixed; so called from Menippus. Varro wrote satires under the title of Satiræ Menippeæ; whence this satire is also called Varronian satire. Among the moderns, a famous piece under this title was published in 1594, against the chiefs of the league, called also the Catholicon of Spain. It is esteemed a master-piece.

MENIPPUS, a cynic philosopher of Phœnicia. He was originally a slave, but purchased his liberty, and became one of the greatest usurers at Thebes. He wrote thirteen books of satires, which have been lost; and at last killed himself.

MENISPERMUM, moonseed, a genus of the decandria order, diœcia class of plants; natural order eleventh, sarmentaceæ: male has four exterior and eight interior petals; there are sixteen stamina; the corolla of the female is the same as in the male; there are eight barren stamina, and two monospermous berries. There are three species, all climbing plants, rising fourteen feet high, and natives of warm climates, but not remarkable for beauty. Of these the

M. cocculus grows in the Levant. The seeds formed into a paste are regarded as specific against lice and cutaneous eruptions. The same paste is likewise used for intoxicating fishes.

MENNO (Simon), the founder of the sect of the Mennonites, was born at Witmarsum, a village near Bolswert, in Friesland, in 1505, and died in 1561 in the duchy of Holstein, at the country seat of a certain nobleman near the city of Oldesloe, who moved with compassion by the perils to which Menno was exposed, and the snares that were daily laid for his ruin, took him, with certain of his associates, into his protection, and gave him an asylum. The writings of Menno, which are almost all written in the Dutch language, were published in folio at Amsterdam in 1651. About 1537 Menno was earnestly solicited by many of his sect to assume the rank and functions of a public teacher; and, as he considered those who made this proposal to be exempt from the fanatical phrenzy of their brethren at Munster, he yielded to their entreaties. From this period to the end of his life he travelled from one country to another, with his wife and children, exercising his ministry, under calamities of various kinds, that succeeded each other without interruption, and constantly exposed to the danger of falling a victim to the severity of the laws. East and West Friesland, with the province of Groningen, were first visited by this zealous apostle of the Anabaptists; whence he directed his course into Holland, Guelderland, Brabant, Westphalia, and the German provinces on the coasts of the Baltic, and penetrated as far as Livonia. In all these places his ministerial labours were attended with remarkable success, and added to his sect a prodigious number of followers. He was a man of genius, directed by a very sound judgment; he possessed a natural and persuasive eloquence, and such a degree of learning as made him pass for an oracle with the multitude. He appears also to have been a man of probity, of a meek spirit, gentle in his manners, pliable and obsequious with persons of all ranks, and extremely zealous in promoting practical religion and virtue, which he recommended both by example and precepts. The plan of discipline drawn up by Menno was much more mild and moderate than that of the furious and fanatical Anabaptists, but somewhat more severe, though more clear and consistent, than that of those branches of the sect who aimed at nothing more than the restoration of the Christian church to its primitive purity. Accordingly he condemned the plan of ecclesiastical discipline, that was founded on the prospect of a new kingdom, to be miraculously established by Jesus Christ on the ruins of civil government and the destruction of human rulers, and which had been the fatal source of dreadful commotions, execrable rebellions, and enormous crimes. He expressed his abhorrence of the licentious tenets, which several Anabaptists had maintained, with respect to polygamy and divorce; as well as some of their fanatical tenets about predictions, visions, &c. He retained indeed the doctrines commonly received among the Baptists of the present day, in relation to the baptism of infants, the connexion of the church with the state, and the abolition of war. These doctrines the eloquence of Menno set off to such advantage, that he acquired a high degree of credit among the Anabaptists; in consequence of which the different sects agreed in excluding from their communion the fanatics that dishonored them, and in renouncing all tenets detrimental to the authority of civil government.

MENNONITES, a sect in the United Provinces, which had its rise in 1536, when Menno Simon, who had been a Romish priest, and a notorious profligate, resigned his rank and office in the Romish church, and publicly embraced the communion of the Baptists. Though the Mennonites usually pass for a sect of Anabaptists, yet M. Herman Schyn, a Mennonite minister, who has published their history and apology, maintains, that they were not Anabaptists either in principle or by origin. However, nothing is more certain, than that the first Mennonite congregations were composed of different sects of Anabaptists, both of those who had been always inoffensive, and of those who, before their conversion by Menno, had been seditious fanatics. The Mennonites are subdivided into several sects; whereof the two principal are the Flanderians or Flemingians, and the Waterlandians. The opinions, says Mosheim, that are held in common by the Mennonites, seem to be all derived from this fundamental principle, that the kingdom which Christ established upon earth is a visible church or community, into which the holy and just alone are to be admitted, and which is exempt from all those institutions and rules of discipline that have been invented by human wisdom, for the correction and reformation of the wicked. They admit none to the sacrament of baptism, but such as are come to the full use of their reason; they neither admit civil rulers into their

communion, nor allow any of their members to perform the functions of magistracy; they deny the lawfulness of repelling force by force, and consider war, in all its shapes, as unchristian and unjust; they entertain the utmost aversion to the execution of justice, and more especially to capital punishment; and they refuse to confirm their testimony by an oath. The particular sentiments that divide the more considerable societies of the Mennonites are the following: The rigid Mennonites, called Flemingians, maintain the opinions of their founder as to the human nature of Christ, alledging that it was produced in the womb of the Virgin by the creating power of the Holy Ghost; the obligation to wash the feet of strangers; the necessity of excommunicating and avoiding, not only avowed sinners, but also all those who depart, even in light instances, as dress, &c., from the simplicity of their ancestors; the contempt due to human learning, and other matters of less moment. However, this austere system declines, and the rigid Mennonites are gradually approaching towards the opinions and discipline of the more moderate or Waterlandians. The first settlement of the Mennonites, in the United provinces, was granted them by William I. prince of Orange, about the close of the sixteenth century; but their liberty and tranquillity were not fixed upon solid foundations, till, by a confession of faith published in 1626, they cleared themselves from the imputation of those detestable errors that had been laid to their charge. To appease their intestine discords a considerable part of the Anabaptists of Flanders, Germany, and Friesland, held a conference at Amsterdam in 1630, and entered into bonds of fraternal communion, each reserving to themselves a liberty of retaining certain opinions. This association was renewed and confirmed by new resolutions in 1649; in consequence of which the rigorous laws of Menno were mitigated and corrected.

MENOCHIA, or Menochius (James), a celebrated lawyer, born at Pavia, but who became so skilful in the law, that he was called the Baldus and Bartholus of his age; all the princes of Italy soliciting him to their universities. He read at Padua twenty-three years, but from love of his country removed to Pavia, and succeeded Nicholas Gratiani. He acquired fame by his works, De Recuperandâ Possessione; De Adipiscendâ Possessione; De Præsumptionibus; De Arbitrariis Judicum Quæstionibus, et Causis Concilicrum, tom. 13, &c. He died in 1607, aged seventy-five.

MENOL'OGY, *n. s.* Fr. *menologe*; Gr. *μηνολογιον*, of *μηνη*, the moon, and *λογος*, a discourse. A register of months.

In the Roman martyrology we find, at one time, many thousand martyrs destroyed by Dioclesian: the *menology* saith they were twenty thousand.

Stillingfleet.

MENOU (James Francis, baron de), a modern French general and politician, was originally a deputy from the nobility of Touraine to the states-general, and one of the first of his order who entered into the commons' chamber. At this time he united himself with the duke of Orleans and the Jacobins, and was employed as mareschal-de-camp at Paris on the 10th of August, 1792. In 1793 he was sent against the insurgents of La Vendée, as general-in-chief, when he displayed great incapacity and was beaten by La Roche-Jacquelin. He was now superseded and returned to Paris. Having the command of a division, he defended the National Convention, in May 1795, against the Jacobins; but on a subsequent occasion his conduct exposed him to a degree of accusation as a traitor: he was however acquitted. He accompanied Buonaparte to Egypt, as general of a division, in which post he displayed considerable talents, but the same deficiency of principle as in earlier life. He turned Mahometan, for the sake of obtaining in marriage the daughter of the keeper of the baths of Rosetta, who was rich; submitted to the peculiar rites of Islamism, and called himself Abdallah James Menou. On Kleber being assassinated, he assumed the chief command, and was opposed to the English under general Abercromby; but he was at length obliged to capitulate, and returned to France in May 1802; Buonaparte immediately appointed him governor of Piedmont he was afterwards sent in a similar character to Venice, where he died August 13th, 1810.

MEN'SAL, *adj.* Lat. *mensalis.* Of or belonging to the table; transacted at table.

Conversation either mental or *mensal.* *Clarissa.*

MENSES, or Catamenia, in medicine, the monthly evacuations from the uterus of women not with child or not giving suck, so called from mensis, month, the period wherein they return. See Midwifery. By the Jewish law a woman was unclean while the menstrual blood flowed. See Lev. xv. 11—29.

The discharge of the menses is interrupted naturally during pregnancy: but this is not always the case, because some have them three months, some six months, and some during the whole time of gestation, though in less quantity than at other times. The menses are also mostly interrupted during the time of giving suck; though many women have a return about the third or fourth month after delivery, and almost all have them again in the ninth or tenth month. In cases of obstruction, the menstrual blood has discharged itself by other outlets. This periodical discharge ceases between forty and fifty; and the season in which this takes place is critical to the sex. However, those who survive this period without contracting any chronical disease, become more healthy and vigorous than they were before. When the menses are about to go off, they appear for the most part irregularly both in time and quantity; once in a fortnight, three, five, or six weeks; sometimes very sparingly, at other times in immoderate quantities. See Medicine.

MENSORES, among the ancient Romans, harbingers, whose business it was to go before the emperor, and fix upon lodgings for him when he travelled into any of the provinces. They also marked out encampments, and assigned every regiment its post.

Mensores were also land-surveyors, architects, or appraisers of houses and public buildings. The distributors of provisions in the army were called mensores frumentarii. Mensores was also an name given to servants who waited at table.

MEN'STRUAL, *adj.* } Fr. *menstruel, men-*
MEN'STRUOUS, } *strues;* Lat. *menstruus,*
MEN'STRUUM, *n. s.* } *mensis,* of Gr. *μηνη*, the moon. Monthly; occurring once a month; pertaining to a menstruum: the several adjectives are particularly applied to the female habit: menstruum is defined below by Quincy and seems, as Dr. Johnson says, to be derived from some notion of the old chemists about the influence of the moon in the preparation of dissolvents. See PHYSIOLOGY AND MEDICINE.

O thou of late beloved,
Now like a *menstruous* woman art removed. *Sandys.*

The dissents of the *menstrual* or strong waters hinder the incorporation, as well as those of the mental. *Bacon.*

Enquire what is the proper *menstruum* to dissolve metal, what will touch upon the one and not upon the other, and what several *menstrua* will dissolve any metal. *Id.*

She turns all her globe to the sun, by moving in her *menstrual* orb, and enjoys night and day alternately, one day of hers being equal to fourteen days and nights of ours. *Bentley.*

All liquors are called *menstruums* which are used as dissolvents, or to extract the virtues of ingredients by infusion, or decoction. *Quincy.*

White metalline bodies must be excepted, which, by reason of their excessive density, seem to reflect almost all the light incident on their first superficies, unless by solution in *menstruums* they be reduced into very small particles, and then they become transparent. *Newton's Opticks.*

MENSURATION.

MEN'SURABLE, *adj.* } Lat. *mensura*, a mea-
MENSURABIL'ITY, *n. s.* } sure. Measurable:
MEN'SURAL, *adj.* } mensural is an un-
MEN'SURATE, *v. a.* } usual word for, relat-
MENSURA'TION, *n. s.* } ing to measure: mensurate, a verb, also seldom used, for to take measure or the dimensions of any thing: mensuration, the act, art, or habit of measuring.

We measure our time by law and not by nature. The solar month is no periodical motion, and not easily *mensurable*, and the months unequal among themselves, and not to be measured by even weeks or days. *Holder.*

After giving the *mensuration* and argumentation of Dr. Cumberland, it would not have been fair to have suppressed those of another prelate. *Arbuthnot.*

MENSURATION is that branch of mathematics by which the relative extents of the spaces occupied by bodies are compared with each other; the comparison being always made with reference to some recognised unit of measure; as in length, a foot, a yard, &c.; in surface, a square inch, a square foot, or any other unit of surface; in solids, a solid inch, foot, or any other understood unit of the same kind; each kind of magnitude having its appropriate unit of measure.

This branch of mathematical science, from its extensive use in every department of life, must be considered as one of the most valuable and important of all the applications of abstract science. It rests for its principle in geometry and arithmetic, with the former of which it was indeed anciently considered as identical.

It has generally been considered that it took its rise as a separate branch of science in Egypt, where, the periodical overflowings of the Nile obliterating every year the marks which indicated the boundaries of property, it was necessary to have some precise method of re-allotting to each individual his share of land on the subsiding of the waters.

The elements of Euclid were probably compiled at first with reference to mensuration alone; as it may be observed that the different trains of reasoning in that admirable compendium, point always, in the end, to the means of measuring some body or figure, or of comparing them with others of a like kind. Thus the first book closes with the means of finding one square that shall be equal to two others; the second with finding a square equal to any given rectilineal figure. His elements afford the means of determining the areas of all rectilineal figures, and of comparing the areas of circles, and the solidities of spheres with each other; but to determine the relation which a circle has to a square, or a sphere to a cube, is a problem which, simple as it may seem, has to the present moment been only approximately determined.

Archimedes contributed greatly to the advancement of mensuration. He found that though the circle could not be squared, there were curvilinear figures that could be squared; and he observed that the parabola was exactly two-thirds of its circumscribing rectangle. He discovered many of the most curious properties of conic sections, and determined the ratio of spheres, spheroids, and conoids to their circumscribing cylinders, and pointed out for the first time, that all that was necessary to complete the quadrature of the circle was to find the ratio of its diameter to its circumference. He also gave the first approximation to this ratio, finding that the diameter to the circumference was nearly as 7 to 22; and consequently that the area of the circle was to that of its circumscribing square nearly as 11 to 14. Since the invention of fluxions these rough approximations have been superseded by others approaching so near the truth, that in a practical point of view nothing would be gained by carrying the approximation further.

The next great step in the improvement of mensuration was made by Cabalerius, who first introduced the idea that a circle might be considered as a polygon of an infinite number of infinitely small sides; that solids were composed of an infinite number of infinitely thin sections. Viewing the figures about which mensuration is conversant in this way, many difficult problems admitted of neat and simple solutions, though the metaphysics of the method are not such as can fully satisfy a geometrician. But Huygens, Walter, and Gregory, made many of their discoveries by the application of this method; which is now, in

the more difficult departments, quite superseded by the doctrine of fluxions. The discovery of fluxions revived among mathematicians the hope of effecting the quadrature of the circle; but the fluent of the fluxion which represented its area in terms of its diameter was found to be one which could only be approximately found.

Mathematicians have since applied themselves very sedulously and successfully to finding the most convenient series, for approximating to the lengths and area of different curves and curvilinear figures. The most complete treatise on mensuration, in all its branches, is that by Dr. Hutton, entitled a Complete Treatise on Mensuration, originally published at Newcastle in a quarto volume, but since in the octavo size. Dr. Hutton also published a practical work on the subject, being an abridgment of his larger one; and Mr. Bonnycastle published a neat and valuable compendium of the practical rules and formulæ, with their investigations and application. An exceedingly compact and complete little work on the subject has also been recently given to the public by Mr. Ingram.

Of the Mensuration of Superficies.

Problem I. *To find the area of a parallelogram.*

Rule 1.—Multiply the length by the perpendicular height, and the product will be the area.

Example.—What is the area of a rhombus whose side is 12·24 feet, and height 9·16 feet?

$12 \cdot 24 \times 9 \cdot 16 = 112 \cdot 1184$ feet. Answer.

Rule 2.—Multiply the product of two adjacent sides by the natural sine of their included angle, for the area.

Example.—What is the area of a parallelogram whose sides are 25·35 and 10·4 chains, and the included angle 30°?

Acres.

$25 \cdot 35 \times 10 \cdot 4 \times$ nat. sin. $30° = 13 \cdot 1820 =$
A. R. P.
13 : 0 : 29.

Prob. II. *To find the area of a triangle.*

Rule 1.—Multiply the base by the perpendicular let fall on it from the opposite angle and half the product will be the area.

Example.—What is the area of a triangle whose base is twenty feet and altitude 10·25?

$$\frac{20 \times 10 \cdot 25}{2} = 102 \cdot 5. \text{ Answer.}$$

Rule 2.—Multiply the product of two of the sides, by half the natural sine of their included angle.

Example.—What is the area of a triangle, of which two sides are 30 and 40, and their included angle 28° 57·3′?

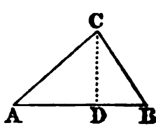
$$\frac{30 \times 40 \times \sin. 28° 57 \cdot 3'}{2} = 290 \cdot 47356.$$

The above rules are immediate consequences of the elementary principles of geometry and trigonometry.

Prob. III. *To find the area of a triangle, of which the sides only are given.*

Rule.—From half the sum of the three sides subtract each side separately, and multiply the half sum and the three remainders continually together; and the square root of the product will be the area.

Demonstration.—Let a, b, and c, represent respectively the sides BC, AC, and AB, of the triangle ABC, CD being the perpendicular. Then by geometry $c : b + a :: b - a : \overline{AD - DB} = \frac{b^2 - a^2}{c}$; hence $AD = \frac{c}{2} + \frac{b^2 - a^2}{2c} = \frac{c^2 + b^2 - a^2}{2c}$. But $CD^2 = \overline{AC + AD} \cdot \overline{AC - AD} = \left(b + \frac{c^2 + b^2 - a^2}{2c}\right) \cdot \left(b - \frac{c^2 + b^2 - a^2}{2c}\right) = \frac{\overline{b + c}|^2 - a^2}{2c} \cdot \frac{a^2 - \overline{b - c}|^2}{2c}$, whence $CD = \frac{1}{2c}\sqrt{(\overline{b + c}|^2 - a^2) \cdot (a^2 - \overline{b - c}|^2)}$ and the area $\frac{AB \cdot CD}{2} = \frac{1}{4}\sqrt{(\overline{b + c}|^2 - a^2) \cdot (a^2 - \overline{b - c}|^2)} = \sqrt{\frac{a + b + c}{2} \cdot \frac{a + b - c}{2} \cdot \frac{a - b + c}{2} \cdot \frac{b + c - a}{2}}$.



Example.—What is the area of a triangle whose sides are twenty, thirty, and forty feet?

$$\sqrt{\frac{20 + 30 + 40}{2} \cdot \frac{20 + 30 - 40}{2} \cdot \frac{20 + 40 - 30}{2} \cdot \frac{30 + 40 - 20}{2}} = 290 \cdot 4737. \text{ Answer.}$$

This rule may be conveniently performed by logarithms.

If S represent half the sum of a, b, and c, the three sides of the triangle, then

$$\frac{\log. S + \log. \overline{S - a} + \log. \overline{S - b} + \log. \overline{S - c}}{2} = \log. \text{ area.}$$

Prob. IV. *To find the area of a trapezium.*

Rule.—Divide it into two triangles by drawing a diagonal, and find the area of each triangle separately, and their sum will be the area of the trapezium; or multiply the diagonal by half the sum of the perpendiculars falling upon it from the opposite angles, and half the product will be the area.

Example.—What is the area of a trapezium whose diagonal is 80·5, and perpendiculars 24·5 and 30·1 respectively?

$$80 \cdot 5 \times \frac{24 \cdot 5 + 30 \cdot 1}{2} = 2197 \cdot 65. \text{ Answer.}$$

Prob. V. *To find the area of a trapezoid.*

Rule.—Divide it into two triangles by drawing

a diagonal to the two opposite angles, as in the trapezium, and the sum of their areas will be the area of the trapezoid. Or multiply the sum of the two parallel sides, by half the perpendicular distance for the area.

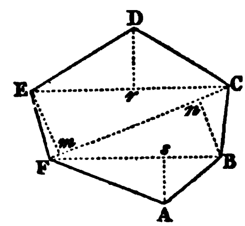
Example.—What is the area of a trapezoid whose parallel sides are 750 and 1225 feet, and perpendicular distance 1540 feet.

$$\overline{750 + 1225} \cdot \frac{1540}{2}. \text{ Answer.}$$

PROB. VI. *To find the area of an irregular rectilineal figure of any number of sides.*

Rule 1.—Divide the figure into triangles and trapeziums, and find the areas of each of them separately by the preceding rules, and the sum of these areas will be the area of the whole figure.

Example.—What is the area of the rectilineal figure A B C D E F, the dimensions being as follows: $FB = 20\cdot75$, $FC = 27\cdot48$, $EC = 18\cdot5$, $Bn = 14\cdot25$, $Em = 9\cdot35$, $Dr = 12\cdot8$, and $As = 8\cdot6$.



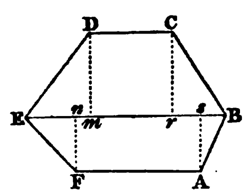
$$\frac{FB \,.\, As}{2} = 89\cdot225 = \text{area } \triangle\, ABF.$$

$$\frac{EC \,.\, Dr}{2} = 118\cdot400 = \quad DEC.$$

$$\frac{Bn + Em}{2} \,.\, FC = \frac{324.2640 = \text{trapezium FBCE.}}{531\cdot889 = \text{area of the whole figure.}}$$

Rule 2. The area of any irregular rectilineal figure may also be found by drawing perpendiculars from all its angles, on one of its diagonals, considered as a base; and then adding the areas of all the triangles and trapezoids togethrer for the content.

Example.—What is the area of the figure A B C D E F, the following being its dimensions: En 4·54, Em 8·26, Er 20·01, Es 26·22, EB 30·15, Dm 10·56, Cr 12·24, Fn 8·56, and As 9·26?



$$\frac{Fm \,.\, En}{2} = 19\cdot4312 = \text{area of } \triangle\, EFn$$

$$\frac{Dm \,.\, Em}{2} = 43\cdot6128 = \quad . \quad . \; EDm$$

$$\frac{Cr \,.\, Br}{2} = 62\cdot0568 = \quad . \quad . \; CBr$$

$$\frac{As \,.\, Bs}{2} = 18\cdot1959 = \quad . \quad . \; ABs$$

$$\frac{(Dm + Cr) \,.\, mr}{2} = 133\cdot9500 = \text{trap. } Cm$$

$$\frac{(En + As) \,.\, ns}{2} = 193\cdot1688 = \quad Fs$$

Sum $\overline{470\cdot4155}$ Answer.

PROB. VII. *To find the area of a regular polygon.*

Rule.—Multiply the square of the side of the polygon by the number standing opposite to its name in the following table, and the product will be the area.

Note.—The areas in the table are those of polygons whose sides are unity.

No. of sides.	Areas or Multipliers.
3	0·4330127
4	1·0000000
5	1·7204774
6	2·5980762
7	3·6339126
8	4·8284272
9	6·1818240
10	7·6942088
11	9·3656411
12	11·1961524

Example.—What is the area of a decagon, or regular polygon of 10 sides, each side being 16?
$7\cdot6942088 \times 16^2 = 196\cdot97174528$. Answer

Rule 2.—Multiply half the sum of the three sides by the perpendicular falling from the centre upon one of the sides, and the product will be the area.

Example.—What is the area of a hexagon, one of whose equal sides is 14·6 feet, and the perpendicular from its centre 12·64 feet?

$$\frac{6 \times 12\cdot64 \times 14\cdot6}{2} = 553\cdot632 \text{ square feet.}$$

Answer.

PROB. VIII. *To find the circumference of a circle, whose diameter is given, or the diameter when the circumference is given.*

Rule.—Multiply the diameter by 3·1416, and the product will be the circumference nearly; or divide the circumference by 3·1416, and the quotient will be the diameter nearly.

Demonstration.—It has been shown, in the article FLUXIONS, that $z =$ the arc of a circle, of which t is the tangent, the $z = t\left\{1 - \frac{t^2}{3r^2} + \frac{t^4}{5r^4} - \frac{t^6}{7r^6}\right.$, &c., in which if z be taken $= 45°$, and $r = 9$, we have $z = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9}$, &c.; and by collecting a sufficient number of terms, and multiplying by 8, we obtain the

circumference of a circle to radius 1 = 6·28318530; or the circumference to the diameter 1, = 3·14159265, to which 3·1416, the number used in the rule, is sufficiently near for ordinary purposes.

Note.—The diameter is to the circumference nearly as 7 to 22.

Example 1.—What is the circumference of a circle whose diameter is 7?

3·1416 × 7 = 21·9912. Answer.

PROB. IX. *To find the length of any arc of a circle.*

Rule.—From eight times the chord of half the arc subtract the chord of the whole arc, and one-third of the remainder will be the arc nearly.

Demonstration.—Let r = the radius, and s = the sine; then c, the chord of half the arc, will be $= \sqrt{s^2 + (r - \sqrt{r^2 - s^2})^2} = s - \frac{s^3}{8r^2} + \frac{7s^5}{128r^4}$; and eight times the chord $= 8s + \frac{s^3}{r^2} + \frac{7s^5}{16r^4}$; whence $\frac{8c - 2s}{3} = 2s + \frac{s^3}{3r^2} + \frac{7s^5}{48r^4}$. But the length of an arc whose sine is s, is known to be $s - \frac{s^3}{6r^2} + \frac{3s^5}{40r^4}$; whence twice that arc is $2s + \frac{s^3}{3r^2} + \frac{s^5}{20r^4}$, differing from the former only by $\frac{s^5}{240r^4}$, which shows the rule to be nearly true.

Example.—If the chord of the whole arc is 50·8, and that of half the arc 30·6, required the length of the arc?

$$\frac{30·6 \times 8 - 50·8}{3} = 66·6. \text{ Answer.}$$

PROB. X. *To find the area of a circle.*

Rule 1.—Multiply the circumference by the diameter, and the fourth part of the product will be the area.

Example.—What is the area of a circle whose radius is 15·25?

By PROB. VIII. the circumference is 2 × 15·25 × 3·1416; hence

$$\frac{2 \times 15·25 \times 3·1416 \times 30·}{4} = 730·6182.$$

Answer.

Rule 2.—Multiply the square of the diameter by ·7854; or the square of the circumference by ·07958; and the product in either case will be the area.

Example.—What is the area of a circle whose diameter is $7\frac{2}{3}$?

$(7\frac{2}{3})^2 \times ·7856 = 46·164$. Answer.

PROB. XI. *To find the area of the space included between two concentric circles.*

Rule.—Multiply the sum of their diameters by their difference, and this product by ·7854, and the result will be the required area.

Example.—Required the area of a ring, the diameters of whose boundary circles are 6 and 4?

$\overline{6 + 4} \,.\, \overline{6 - 4} \times ·7854 = 15·708$. Answer.

PROB. XII. *To find the area of a sector of a circle.*

Rule.—Let d = the diameter, c the chord of the arc, and v its versed sine, thus the area $= \frac{dc}{4} + \frac{c^3}{2\,.\,3\,.\,d^2}A + \frac{3^2 c^3}{4\,.\,5\,.\,d^2}B + \frac{5^2 c^3}{6\,.\,7\,.\,d^2}C'$, &c.; or $\frac{d\sqrt{dv}}{2} + \frac{v}{2\,.\,3\,.\,d}A + \frac{3^2 v}{4\,.\,5\,.\,d}B + \frac{5^2 v}{6\,.\,7\,d}C'$, &c.; whence A B and C represent the terms immediately preceding those where they first occur.

Example.—What is the area of a section whose height is 2, the diameter of the circle being 52?

$$\text{Here } \frac{d\sqrt{dv}}{2} = 26\sqrt{104} \qquad = 265·149014 \text{ (A).}$$

$$\frac{v}{2\,.\,3\,d}\ A = \frac{2}{6·52} \qquad A = \quad 1·699673 \text{ (B).}$$

$$\frac{3^2 v}{4\,.\,5\,.\,d}\ B = \frac{2·9}{20·52} \qquad B = \quad ·029417 \text{ (C).}$$

$$\frac{5^2 v}{6\,.\,7\,.\,d}\ C = \frac{2·25}{42·52} \qquad C = \quad ·000673 \text{ (D).}$$

$$\frac{7^2 v}{8 \cdot 9 \cdot d}\ D = \frac{2·49}{72·52} \qquad D = \quad 000018 \text{ (E).}$$

$$\frac{9^2 v}{10\,.\,11 \cdot d}\ E = \frac{2·81}{110·52} \qquad E = \quad 000001 \text{ (F).}$$

266·878796. Answer.

PROB. XIII. *To find the area of the segment of a circle.*

Rule.—The notation adopted in the preceding example being employed, the area of the segment is $= \frac{4v\sqrt{dv}}{3} - \frac{3v}{2\,.\,5\,.\,d}A - \frac{5v}{4\,.\,7\,.\,d}B - \frac{3\,.\,7v}{6 \cdot 9d}C - \frac{5\,.\,9v}{8\,.\,11\,.\,d}$, &c.

Example.—What is the area of a segment of a circle whose versed sine is 3, the diameter of the circle being 60?

Here $+\frac{12\sqrt{dv}}{3}$ $=$ A $=$ 53·665632

$-\frac{3v}{2\cdot5\cdot d}$ A $= -$B $= -$·804984

$-\frac{5v}{4.7.d}$ B $= -$C $= -$·007187

$-\frac{3.7v}{6.9\cdot d}$ C $= -$D $= -$·000139

$-\frac{5.9.v}{8.11.d}$ D $= -$E $= -$·000003

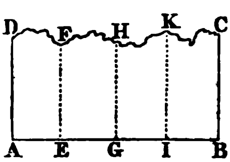
—·812313

Answer. 52·853319

Prob. XIV. *To find the area of a figure formed of right lines and curves.*

Practical Rule. — Take the perpendicular breadths of the figure in several places, at equal distances from each other, and divide their sum by the number of them for the mean breadth; and this mean breadth multiplied by the length of the figure will give the area nearly.

Example.—The perpendicular breadths of the irregular figure A B C D, at five equidistant places, A, E, G, I, B, are 9·2, 10·5, 8·3, 9·4, and 10·7; and its length A B is 20, what is its area?



$$\frac{9{\cdot}2 + 10{\cdot}5 + 8{\cdot}3 + 9{\cdot}4 + 10{\cdot}7}{5} \times 20 =$$

190·7500. Answer.

Prob. XV. *To find the circumference of an ellipse.*

Rule 1.—Multiply the square root of half the sum of the squares of the two diameters, and the product will be the circumference nearly.

Demonstration.—If $t =$ the transverse, c the conjugate, $p = 3{\cdot}1416$, and $d = 1 - \frac{c^2}{t^2}$; then, as may be shown by fluxions, $pt\left\{1 - \frac{d}{2.2} - \frac{3d^2}{2.2.44} - \frac{3.3.5.d^3}{2.2.4.4.66}\right.$, &c. $=$ the circumference. Now the above rule is $p\frac{\sqrt{t^2+c^2}}{2} = pt\sqrt{\frac{1}{2}+\frac{c^2}{2t^2}} = pt\sqrt{1-\frac{d}{2}} = pt$ $\left\{1 - \frac{d}{2\cdot2} - \frac{d^2}{2^3.4} - \frac{3d^3}{2^4.4.6}\right.$, differing from the former only by $\frac{d^3}{64}$.

Rule 2.—Multiply half the sum of the diameters by 3·1416, and the product will give the circumference exact enough for most practical purposes.

Example.—What is the circumference of an ellipse whose diameters are 24 and 20?

By *Rule* 1.—$\frac{24^2 + 20^2}{2} \times 3{\cdot}1416 = 69{\cdot}3979$. Answer.

Prob. XVI. *To find the area of an ellipse.*

Rule.—Multiply the transverse diameter by the conjugate, and the product again by 7854, and the result will be the area.

Exrmple.—If the axes of an ellipse be 70 and 50, what is its area?

$70 \times 50 \times {\cdot}7854 = 2748{\cdot}9$. Answer.

Prob. XVII.—*To find the area of any segment of an ellipse, the base of the segment being parallel to one of the diameters.*

Rule. Divide the height of the segment by the axis, of which it is a part, and find by Prob. XIII. the area of a circular segment, whose diameter is unity, and height the quotient produced by so dividing. Multiply this circular area by the product of the two axes of the ellipse, and the result will be the area of the segment.

Demonstration.—Call the transverse t, the conjugate c, the abscissa x, and the ordinate y; then (see Conics) $y = \frac{c}{t}(tx - x^2)^{\frac{1}{2}}$, whence the fluxion of the area is $\frac{c}{t} \times \dot{x}\,(tx - x^2)^{\frac{1}{2}}$. But $\dot{x}$ $(tx - x^2)^{\frac{1}{2}}$ is the fluxion of the corresponding circular segment, whose versed sign is x and diameter t. Denoting the fluent of this expression by F, we have the fluent of $\frac{c}{t} \times \dot{x}\,(tx - x^2)^{\frac{1}{2}} = \frac{c}{t}$. F; from which both this and the preceding rule are deduced.

Example.—What is the area of the elliptic segment whose height is 10, the axes being 35 and 25 respectively, the base of the segment being parallel to the minor axis?

Here $\frac{10}{35} = {\cdot}2857 =$ versed sine of corresponding circular segment to radius unity; whose area therefore is ·185135. Here $\cdot185135 \times 35 \times 25 = 161{\cdot}993125$, the required area.

Prob. XVIII. *To find the length of an arc of a parabola cut off by a double ordinate.*

Rule.—To the square of the ordinate add four-thirds of the square of the abscissa 1, and twice the square root of the sum will be the length of the arc nearly.

Demonstration.—It may easily be shown, by the aid of fluxions, that z being the arc, y the abscissa, and p the perimeter, $z = 2\cdot y\left\{1 + \frac{4}{2.3}\cdot\frac{y^2}{p^2} - \frac{4^2}{2.4.5}\cdot\frac{y^4}{p^4} + \frac{3.4^3}{2.4.6.7}\cdot\frac{y^6}{p^6}\right.$, &c.; and the above rule is $z = 2\sqrt{y^2 + \frac{4}{3}x^2} = 2\sqrt{y^2 + \frac{4}{3}\cdot\frac{y^4}{p^2}} = 2y\left\{1 + \frac{4}{2.3}\cdot\frac{y^2}{p^2} - \frac{4^2}{2.4.3^2}\cdot\frac{y^4}{p^4}\right.$, &c., which differs from the pre-

ceding by only four forty-fifths of a unit in the third term: and shows the rule therefore to be a close approximation.

Example.—The abscissa is 2, and its ordinate 6, what is the length of the parabolic arc?

$$2\sqrt{6^2 + \frac{4}{3} \cdot 2^2} = 2\sqrt{41 \cdot 3333} = 12 \cdot 858.$$

Answer.

PROB. XIX. *To find the area of a parabola.*

Rule.—Multiply the base by two-thirds of the height, and the product will be the area.

Demonstration.—The abscissa being x, the ordinate y, and the perimeter p, we have the fluxion of the area $= y\dot{x} = \dot{x}\sqrt{p x}$, and its fluent $= \frac{2x}{3} \times \sqrt{p x} = \frac{2x}{y} \cdot y$.

Example.—The abscissa being 12, and the double ordinate 38, what is the area?

$$38 \times \frac{2 \times 12}{3} = 304 \quad \text{Answer.}$$

PROB. XX. *To find the area of the frustum of a parabola.*

Rule.—Divide the difference of the cubes of the two ends of the frustum by the difference of the squares, and multiply the quotient by two-thirds of the breadth of the frustum for the area.

Demonstration.—Let D and d represent the length of the ends, and a the breadth; then by the nature of the curve $\frac{a D^2}{D^2 - d^2} =$ the abscissa reckoned from the vertex to the bottom of the frustum, and $\frac{a d^2}{D^2 - d^2} =$ the abscissa from the vertex to the top. Hence $\frac{2}{3} D \times \frac{a D^2}{D^2 - d^2} - \frac{2}{3} d \times \frac{a d^2}{D^2 - d^2} = \frac{2}{3} a \frac{D^3 - d^3}{D^2 - d^2}$, the required area.

PROB. XXI. *To find the length of an arc of an hyperbola.*

Rule.—To nineteen times the square of the transverse add twenty-one times the square of the conjugate; and to nine times the square of the transverse add twenty-one times the square of the conjugate; and multiply each sum by the abscissa. To each of the products add fifteen times the product of the transverse and the square of the conjugate. Then, as the less of these results is to the greater, so is the ordinate to the length of the arc nearly.

PROB. XXII. *To find the area of an hyperbola, the transverse conjugate and abscissa being given.*

Rule.—To the product of the transverse and abscissa add five-sevenths of the square of the abscissa, and multiply the square root of the sum by twenty-one. Add four times the square root of the product of the transverse and abscissa to the last product, and divide the sum by seventy-five. Then, if four times the product of the conjugate and abscissa be divided by the transverse, this last quotient multiplied by the former will give the area nearly.

ON THE MENSURATION OF SOLIDS.

PROB. XXIII. *To find the solidity of prisms and cylinders.*

Rule.—Multiply the area of the end by the perpendicular altitude, and the product will be the solidity.

Example.—What is the solidity of a prism whose base is a regular hexagon, each of the equal sides being one foot four inches, and the length fifteen feet?

By Prob. VII., $\overline{1\frac{1}{3}}^2 \times 2 \cdot 5980762 =$ the area of the end; hence $(1\frac{1}{3})^2 \times 2 \cdot 5980762 \times 15 =$ 69·282 feet. Answer.

PROB. XXIV. *To find the convex surface of an upright cylinder.*

Rule.—Multiply the circumference of the base by the height of the cylinder, and the product will be the convex surface required.

Example.—Required the convex surface of a cylinder whose diameter is thirty inches, and length sixty inches?

By Prob. VIII. $3 \cdot 1416 \times 30$ is the circumference; when $3 \cdot 1416 \times$ by $30 \times 60 = 5654 \cdot 862$, the required surface.

PROB. XXV. *To find the convex surface of a right cone or pyramid.*

Rule.—Multiply half the circumference of the base by the slant height, and the product will be the convex surface.

Example.—The circumference of the base is 10·75, and the slant height 18·25, what is the convex surface?

$$\frac{10 \cdot 75}{2} \times 18 \cdot 25 = 98 \cdot 09375 \text{ square feet.}$$

Answer.

PROB. XXV.* *To find the convex surface of the frustum of a right cone or pyramid.*

Rule.—Multiply half the sum of the perimeters of the two ends by the slant height of the frustum, and the product will be the area.

Example.—The circumferences of the ends of the frustum of a pyramid are thirty and ten feet, and its slant height twenty feet, required its convex surface.

$$\frac{30 + 10}{2} \times 20 = 400. \quad \text{Answer.}$$

Note. The demonstration of the three preceding rules is too simple to need any formal statement.

PROB. XXVI. *To find the solid content of a cone or pyramid.*

Rule.—Multiply the area of the base by the perpendicular height, and one-third of the product will be the solidity.

This rule is demonstrated in the article GEOMETRY.

Example.—Required the solidity of a hexagonal prism, each of its equal sides being forty, and its altitude sixty.

By Prob. VII. the area of its base is $40^2 \times 2 \cdot 5980762$; therefore $\frac{40^2 \times 2 \cdot 5980762 \times 60}{3} = 83138.432$. Answer.

PROB. XXVII. *To find the solidity of the frustum of a cone or pyramid.*

Rule 1.—For the frustum of a cone, the dia-

meters of the ends and the height being given. Divide the difference of the cubes of the diameters by the difference of the diameters, multiply the quotient by ·7856, and again by one-third of the height, and the result will be the solidity.

Rule 2. For the frustum of a pyramid when the sides of the base and the height are given. To the areas of the ends add the square root of their product, and multiply the sum by one-third of the height for the solidity.

Demonstration.—Let D and d be the greater and less diameters of the conical frustum, h the height, and $p = \cdot 7854$, then, $\frac{d\,h}{D - d} =$ the height of the part cut off from the top of the cone, and $h + \frac{d\,h}{D - d} =$ whole height of the cone. Hence, $\frac{p\,D^2}{3} \times \left(h + \frac{d\,h}{D - d}\right) - \frac{p\,d^2}{3} \times \frac{d\,h}{D - d} =$ the solidity of the frustum. This reduced, becomes $\frac{D^3 - d^3}{D - d} \cdot \frac{h\,p}{3}$; the rule for the cone. In a similar way is the rule for the pyramidal frustum demonstrated.

Example.—What is the solidity of the frustum of a cone, the diameter of the greater end being four feet, of the less end two feet, and altitude six feet?

$$\frac{4^3 - 2^3}{4 - 2} \cdot \frac{6 \times \cdot 7854}{3} = 65\cdot 9736. \text{ Answer}$$

PROB. XXVIII. *To find the solidity of a wedge.*

Rule.—Add twice the length of the base to the length of the edge; multiply the sum by the height of the wedge, and again by the breadth of the base, and one-sixth of the last product will be the solidity.

Demonstration.—Let L = length of the base, b its breadth, l the length of the edge, and h the height of the edge. Then by the preceding rule we have $\frac{b\,l\,h}{2} \pm b\,h \times \frac{\mp L \pm l}{3} = b\,h \times \frac{2\,L + l}{6}$.

Example.—How many solid feet are in a wedge whose base is sixty-four inches long and nine broad, the length of the edge being forty-two inches, and the perpendicular height twenty-eight inches?

$$\frac{(2 \times 64 + 42) \times 28 \times 9}{6} = 7140 \text{ solid inches,}$$

or 4·1319 solid feet.

PROB. XXIX. *To find the solidity of a prismoid.*

Rule.—To the sum of the areas of the two ends add four times the area of a section parallel to, and equally distant from, both ends, and multiply the sum by one-tenth of the height for the solidity.

Demonstration.— Let B = the breadth of the greater end, b = that of the less; L and l their lengths, and h their height; then, by the last problem, the solidity is $(\overline{2\,L + l}\,.\,B + \overline{2\,l + L}\,.\,b)\,.\,\frac{h}{6}$; which, by taking $M = \frac{L + l}{2}$ and $m = \frac{B + l}{2}$ becomes $(B\,L + b\,l + 4\,M\,m)\,\frac{h}{6}$; which is the rule.

Example.—The dimensions of a waggon are at top 81·5 inches by 55; and at bottom 41 inches by 29·5; and perpendicular depth 47·25, required its capacity?

$$\frac{81\cdot 5 \times 55 + 41 \times 29\cdot 5 + \overline{81\cdot 5 + 41} \times \overline{55 + 29\cdot 5}}{6} = 73\cdot 1133 \text{ cubic feet. Answer.}$$

PROB. XXX. *To find the convex surface of a sphere.*

Rule.—Multiply the diameter of the sphere by its circumference, and the product will be the convex surface.

Demonstration.—Let $p = 3\cdot 1416$, x the abscissa, y the ordinate, and z the corresponding arc, and $d =$ the diameter. Then by fluxions $2\,p\,y\,\dot{z}$ is the fluxion of the surface, and $\dot{z} = (\dot{x}^2 + \dot{y}^2)^{\frac{1}{2}}$, and by the property of the circle $\dot{y}^2 = \frac{\left(\frac{d}{2} - x\right)^2 \dot{x}^2}{d\,x - x^2}$ in substituting these values in the expression for the fluxion of the surface, reducing and taking the fluent we have $p\,d\,x$ for the surface of the segment whose height is x, which, when $x = d$, becomes $p\,d^2$, which is the rule.

Example.—What is the surface of a sphere whose diameter is 1⅓ feet, and circumference 4·1888 feet.

$$4\cdot 1888 \times \frac{4}{3} = 5\cdot 58506 \text{ square feet. Answer.}$$

PROB. XXXI. *To find the solidity of a sphere.*

Rule.—Multiply the centre of the diameter by ·5236, and the product will be the solidity.

Demonstration.—Adopting the notation in the preceding problem, we have $p\,d\,x\,\dot{x} - p\,x^2\,\dot{x}$ for the fluxion of the solidity, whose fluent gives $\frac{3\,p\,d\,x^2 - 2\,p\,x^3}{6}$ for the solidity of the segment whose altitude is x; and, when $x = d$, the expression becomes $\frac{p\,d^3}{6} = d^3 \times \cdot 5236$.

Example.—What is the solidity of the earth, supposing it a perfect sphere of 7957¾ miles diameter.

$(7957\frac{3}{4})^3 \times \cdot 5236 = 263858149120$ entire miles. Answer.

PROB. XXXII. *To find the solidity of the segment of a sphere.*

Rule.—To three times the square of the radius of its base add the square of its height, multiply the sum by the height, and by ·5236 for the solidity.

Demonstration.—By the last problem we had $(3\,d\,x^2 - r\,x^3)\,\frac{p}{6} =$ the solidity of the segment; and $\frac{r^2 + x^2}{x} = d$, r being the radius of the base of the segment; whence, by substitution and re-

duction, we have the solidity $= (3\,r^2 + h^2)\,\frac{p\,h}{6}$ which is the rule.

Example.—What is the solidity of a segment of a sphere, the diameter of whose base is twenty, and height nine?

$(3\,.\,\overline{10}^2 + 9^2) \times 9 \times \cdot 5236 = 1795\cdot 4246\cdot$ Answer.

PROB. XXXIII. *To find the solidity of a frustum or zone of a sphere.*

To the sum of the squares of the radii of two ends add one-third of the square of their distance; and multiply the sum by the breadth, and by 1·5708 for the solidity.

Demonstration.—Let H and h be the heights of the two segments of which the zone is the difference, and R, r, the radii of their bases; then by the last problem $\frac{p}{6}\left\{(3\,R^2\,H + H^3) - (3\,r^2\,h - h^3)\right\}$ is the solidity of the zone whose height is $H - h$. Hence, putting a for the altitude of the frustum, we have by substituting eliminating and reducing $\left(R^2 + r^2 + \frac{a^2}{3}\right)\frac{p}{2}$, which is the rule.

Example.—What is the solidity of a zone whose greater diameter is twenty-four inches, less twenty inches, and breadth four inches?

$\left(12^2 + 10^2 + \frac{4^2}{3}\right) \times 4 \times 1\cdot 5708 = 1566\cdot 6112$ inches. Answer.

PROB. XXXIV. *To find the solidity of a circular spindle, whose length and middle diameter are given.*

Rule.—From one-third of the cube of half the length of the spindle subtract the product of the central distance and half the area of the generating segment, and multiply the remainder by 12·5664 for the solidity.

PROB. XXXV. *To find the solidity of the middle frustum of a circular spindle, its length, middle diameter, and that of either of its ends, being given.*

Rule.—From the square of half the length of the spindle subtract one-third of the square of half the length of the frustum, and multiply the remainder by the half length. From the product take that of the area, and the central distance, and multiply the remainder by 6·2832, for the solidity.

PROB. XXXVI. *To find the solidity of a spheroid, its two axes being given.*

Rule.—Multiply the square of the revolving axis by the fixed axis, and the product again by ·5236 for the solidity.

PROB. XXXVII. *To find the solidity of the middle frustum of a spheroid, the dimensions of the frustum being given.*

Rule.—Case 1. When the ends are circular, or perpendicular to the fixed axis.—To twice the square of the middle diameter add the square of the diameter of either of the ends, and multiply the same by the length of the frustum, and by ·2618, and the result will be the solidity.

Case 2. When the ends are elliptical or perpendicular to the revolving axis.—Multiply twice the transverse diameter of the middle section by its conjugate diameter, and to this product add the product of the transverse and conjugate diameter of either of the ends. Multiply this sum by the length of the frustum, and by ·2618, and the product will be the solidity.

PROB. XXXVIII. *To find the solidity of the segment of a spheroid.*

Rule.—Case 1. When the base is perpendicular to the fixed axis.—Divide the square of the revolving axis by the square of the fixed axis, and multiply the quotient by the difference between three times the fixed axis and twice the height of the segment. Multiply this last product by the square of the height of the segment, and again by ·5236, and the result will be the solidity.

Case 2. When the base is perpendicular to the revolving axis.—Divide the fixed axis by the revolving axis, and multiply the quotient by the difference between three times the revolving axis and the height of the segment. Multiply the product by the square of the height of the segment, and again by ·5236, and it will give the solidity required.

PROB. XXXIX. *To find the solidity of a paraboloid.*

Rule.—Multiply the area of the base by the height, and half the product will be the solidity.

PROB. XL. *To find the solidity of the frustum of a paraboloid when its ends are perpendicular to the axis of the solid.*

Rule.—Multiply the sum of the squares of the diameters of the ends by the height of the frustum, and the product by ·3927, and it will give the solidity.

PROB. XLI. *To find the solidity of a parabolic spindle.*

Rule.—Multiply the square of the middle diameter by the length of the spindle, and the product by ·418879, and it will give the solidity.

PROB. XLII. *To find the solidity of the middle frustum of a parabolic spindle, whose dimensions are given.*

Rule.—To eight times the square of the middle diameter add three times the square of the less, and four times their product; multiply this sum by the length, and the product again by ·05236, and it will give the solidity.

PROB. XLIII. *To find the solidity of a hyperboloid.*

Rule.—As the sum of the transverse axis of the generating hyperbola and the height of the solid, is to the sum of the transverse axis and two-thirds of the height, so is half the area of the base, multiplied by the altitude, to the solidity of the hyperboloid.

PROB. XLIV. *To find the solidity of the frustum of a hyperboloid.*

Rule.—Add together the square of the greater and less semi-diameters, and square of the whole diameter in the middle; multiply the sum by the altitude, and by ·5236, for the solidity.

PROB. XLV.—*To find the surfaces and solidities of regular bodies.*

Rule 1.—Multiply the square of the lineai edge by the tabular area in the annexed table, and the product will be the superficies.

Rule 2.—Multiply the centre of the linear edge by the tabular solidity in the annexed table, and the product will be the solidity.

SURFACES AND SOLIDITIES OF REGULAR BODIES WHEN THE LOWER EDGE IS 1.

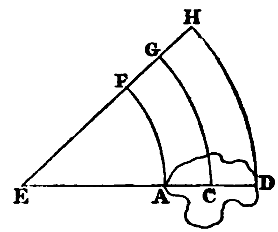
No. of Sides.	Surfaces.	Solidities.
4	1·73205	0·11785
6	6·00000	1·00000
8	3·46410	0·47140
12	20·64578	7·66312
20	8·66025	2·18169

The demonstrations of such of the preceding problems as want of room has obliged us to omit, may be seen in Bonnycastle's Treatise on Mensuration, before mentioned; with a copious collection of examples for exercises.

We shall close this article with an extract from Dr. Hutton's valuable work on Mensuration, on the relation between the areas of figures and the centres of gravity of their generating planes and lines, commonly called the centrobaric method.

Proportion.—If any line, straight or curved, or any plain figure, whether bounded by right lines or curves, revolve about an axis in the plane of the figure; the surface or solid generated will be equal to the surface or solid whose base is the given line or figure, and height the arc described by the centre of gravity of the said generating line or figure.

Demonstration.—Let AFHD be the figure generated by the given line or plane ACD; through C, the centre of gravity, of which draw DCAE perpendicular to the axis of revolution, and meeting HGFE in E, and let every point



of the base be reduced to AD by means of perpendiculars to it. The figure AFHD generated, is equal to all the AF's, CG's, &c., which are as all the EA's, FC's, &c., or as so many times EC, by the doctrine of mechanics. Hence the sum of all the AF's, CG's, &c., is equal to so many times CG, or equal to AD × CG; that is, the figure AFHD is equal to ABD × CG, or the base unto the line described by the centre of gravity.

By the application of this elegant principle, the areas and solidities of many surfaces and bodies, which may be conceived to be generated either by direct motion or revolution, may very readily be deduced.

TABLE of Circular Segments to Radius ½.

Versed sine.	Area of segment.	Versed sine.	Area of segment.	Versed sine.	Area of segment.	Versed sine.	Area of segment.	Versed sine.	Area of segment.
·001	·000042	·051	·015119	·101	·041476	·151	·074589	·201	·112624
·002	·000119	·052	·015561	·102	·042080	·152	·075306	·202	·113426
·003	·000219	·053	·016007	·103	·042687	·153	·076026	·203	·114230
·004	·000337	·054	·016457	·104	·043296	·154	·076740	·204	·115035
·005	·000470	·055	·016911	·105	·043908	·155	·077469	·205	·115842
·006	·000618	·056	·017369	·106	·044522	·156	·078194	·206	·116650
·007	·000779	·057	·017831	·107	·045139	·157	·078921	·207	·117460
·008	·000951	·058	·018296	·108	·045789	·158	·079649	·208	·118271
·009	·001135	·059	·018766	·109	·046381	·159	·080380	·209	·119083
·010	·001329	·060	·019239	·110	·047005	·160	·081112	·210	·119897
·011	·001533	·061	·019716	·111	·047632	·161	·081846	·211	·120712
·012	·001746	·062	·020196	·112	·048262	·162	·082582	·212	·121529
·013	·001968	·063	·020680	·113	·048894	·163	·083320	·213	·122347
·014	·002199	·064	·021168	·114	·049528	·164	·084059	·214	·123167
·015	·002438	·065	·021659	·115	·050165	·165	·084801	·215	·123988
·016	·002685	·066	·022154	·116	·050804	·166	·085544	·216	·124810
·017	·002940	·067	·022652	·117	·051046	·167	·086289	·217	·125634
·018	·003202	·068	·023154	·118	·052090	·168	·087036	·218	·126459
·019	·003471	·069	·023659	·119	·052736	·169	·087785	·219	·127285
·020	·003748	·070	·024168	·120	·053380	·170	·088535	·220	·128113
·021	·004031	·071	·024680	·121	·054036	·171	·089287	·221	·128942
·022	·004322	·072	·025195	·122	·054689	·172	·090041	·222	·129773
·023	·004618	·073	·025714	·123	·055345	·173	·090797	·223	·130605
·024	·004921	·074	·026236	·124	·056003	·174	·091554	·224	·131438
·025	·005230	·075	·026761	·125	·056663	·175	·092318	·225	·132272
·026	·005546	·076	·027289	·126	·057326	·176	·093074	·226	·133108
·027	·005867	·077	·027821	·127	·057991	·177	·093836	·227	·133945
·028	·006194	·078	·028356	·128	·058658	·178	·094601	·228	·134784
·029	·006527	·079	·028894	·129	·059327	·179	·095366	·229	·135624
·030	·006865	·080	·029435	·130	·059999	·180	·096134	·230	·136465
·031	·007209	·081	·029979	·131	·060672	·181	·096903	·231	·137307
·032	·007558	·082	·030526	·132	·061348	·182	·096674	·232	·138150
·033	·007913	·083	031076	·133	·062026	·183	·098447	·233	·138995
·034	·008273	·084	·031629	·134	·062707	·184	·099221	·234	·139841
·035	·008638	·085	·032186	·135	·063389	·185	·099997	·235	·140688
·036	·009008	·086	·032745	·136	·064074	·186	·100774	·236	·141537
·037	·009383	·087	·033307	·137	·064760	·187	·101553	·237	·142387
·038	·009763	·088	·033872	·138	·065449	·188	·102334	·238	·143238
·039	·010148	·089	·034441	·139	·066149	·189	·103116	·239	·144091
·040	·010537	·090	·035011	·140	·066833	·190	·103900	·240	·144944
·041	·010931	·091	·035585	·141	·067528	·191	·104685	·241	·145799
·042	·011330	·092	·036162	·142	·068225	·192	·105472	·242	·146655
·043	·011734	·093	·036741	·143	·068924	·193	·106261	·243	·147512
·044	·012142	·094	·037323	·144	·069625	·194	·107051	·244	·148371
·045	·012554	·095	·037909	·145	·070328	·195	·107842	·245	·149230
·046	·012971	·096	·038496	·146	·070033	·196	·108636	·246	·150091
·047	·013392	·097	·039087	·147	·071741	·197	·109430	·247	·150953
·048	·013818	·098	·039680	·148	·072450	·198	·110226	·248	·151816
·049	·014247	·099	·040276	·149	·073161	·199	·111024	·249	·152680
·050	·014681	·100	·040875	·150	·073874	·200	·111823	250	·153546

TABLE of Circular Segments to Radius ½.—*Continued.*

Versed Sine.	Area of Segment.	Versed Sine.	Area of Segment.	Versed Sine.	Area of Segment.	Versed Sine.	Area of Segment.	Versed Sine.	Area of Segment.
·251	·151412	·301	·199085	·351	·245934	·401	·294349	·451	·343777
·252	·155280	·302	·200003	·352	·246889	·402	·295330	·452	·344772
·253	·156149	·303	·200922	·353	·247845	·403	·296311	·453	·345768
·254	·157019	·304	·201841	·354	·248801	·404	·297292	·454	·346764
·255	·157890	·305	·202761	·355	·249757	·405	·298273	·455	·347759
·256	·158762	·306	·203863	·356	·250715	·406	·299255	·456	·348755
·257	·159636	·307	·204605	·357	·251673	·407	·300238	·457	·349752
·258	·160510	·308	·205527	·358	·252631	·408	·301220	·458	·350748
·259	·161386	·309	·206451	·359	·253590	·409	·302203	·459	·351745
·260	·162263	·310	·207376	·360	·254550	·410	·303187	·460	·352741
·261	·163140	·311	·208301	·361	·255510	·411	·304171	·461	·353789
·262	·164019	·312	·209227	·362	·256471	·412	·305155	·462	·354736
·263	·164899	·313	·210154	·363	·257433	·413	·306140	·463	·355732
·264	·165780	·314	·211082	·364	·258395	·414	·307125	·464	·356730
·265	·166663	·315	·212011	·365	·259357	·415	·308110	·465	·357727
·266	·167546	·316	·212940	·366	·260320	·416	·309095	·466	·358725
·267	·168430	·317	·213871	·367	·261284	·417	·310081	·467	·359723
·268	·169315	·318	·214802	·368	·262248	·418	·311068	·468	·360721
·269	·170902	·319	·215733	·369	·263213	·419	·312054	·469	·361719
·270	·171089	·320	·216666	·370	·264178	·420	·313041	·470	·362717
·271	·171978	·321	·217599	·371	·265144	·421	·314029	·471	·363715
·272	·172867	·322	·218533	·372	·266111	·422	·315016	·472	·364713
·273	·173758	·323	·219468	·373	·267078	·423	·316004	·473	·365712
·274	·174649	·324	·220404	·374	·268048	·424	·316992	·474	·366710
·275	·175542	·325	·221340	·375	·269013	·425	·317981	·475	·367709
·276	·176435	·326	·222277	·376	·269982	·426	·318970	·476	·368708
·277	·177330	·327	·223215	·377	·270951	·427	·319959	·477	·369707
·278	·178225	·328	·224154	·378	·271920	·428	·320948	·478	·370706
·279	·179122	·329	·225093	·379	·272890	·429	·321938	.479	·371705
·280	·180019	·330	·226033	·380	·273816	·430	·322928	·480	·372704
·281	·180918	·331	·226974	·381	·274832	·431	·323918	·481	·373703
·282	·181817	·332	·227915	·382	·275803	·432	·324909	·482	·374702
·283	·182718	·333	·228858	·383	·276775	·433	·325900	·483	·375702
·284	·183619	·334	·229801	·384	·277748	·434	·326892	·484	·376702
·285	·184521	·335	·230745	·385	·278721	·435	·327882	·485	·377701
·286	·185425	·336	·231689	·386	·279694	·436	·328874	·486	·378701
·287	·186329	·337	·232684	·387	·280668	·437	·329866	·487	·379700
·288	·187234	·338	·233580	·388	·281642	·438	·330858	·488	·380700
·289	·188140	·339	·234526	·389	·282617	·439	·331850	·489	·381699
·290	·189047	·340	·235473	·390	·283592	·440	·332843	·490	·382699
·291	·189955	·341	·236421	·391	·284568	·441	·333836	·491	·383699
·292	·190864	·342	·237369	·892	·285544	·442	·334829	·492	·384699
·293	·191775	·343	·238318	·393	·286521	·443	·335822	·493	·385699
·294	·192684	·344	·239268	·394	·287498	·444	·336816	·494	·386699
·295	·193596	·345	·240218	·395	·288476	·445	·337310	·495	·387699
·296	·194509	·346	·241169	·396	·289453	·446	·338804	·496	·388699
·297	·195422	·347	·242121	·397	·290432	·447	·339798	·497	·389699
·298	·196337	·348	·243074	·398	·291411	·448	·340793	·498	·390699
·299	·197252	·349	·244026	·399	·292390	·449	·341787	·499	·391699
·300	·198168	·350	·244980	·400	·293396	·450	·342782	·500	·392699

MENTAL, *adj.* } Fr. *mentale*; Lat. *mens*, MEN'TALLY, *adv.* } *mentis*, the mind. Intellectual; of or relating to the mind: hence, not openly or externally.

What a *mental* power
This eye shoots forth! How big imagination
Moves in this lip! To the dumbness of the gesture
One might interpret. *Shakspeare. Timon of Athens.*

This beholding, therefore, is with *mental* eyes: and not with every sudden glance, but with deep considerations. *Bp. Hall.*

So deep the power of these ingredients pierced,
Even to the inmost seat of *mental* sight,
That Adam, now enforced to close his eyes,
Sunk down, and all his spirits became entranced.
Milton.

If the ideas be not innate, there was a time when the mind was without those principles; for, where the ideas are not, there can be no knowledge, no assent, no *mental* or verbal propositions about them. *Locke.*

The metaphor of taste would not have been so general, had there not been a conformity between the *mental* taste and that sensitive taste that affects the palate. *Addison.*

She kindly talked, at least three hours,
Of plastick forms, and *mental* powers. *Prior.*

If we consider the heart the first principle of life, and *mentally* divide it into its constituent parts, we find nothing but what is in any muscle of the body. *Bentley.*

Those inward representations of spirit, thought, love, and hatred, are pure and *mental* ideas, belonging to the mind, and carry nothing of shape or sense in them. *Watts.*

Unwise, who, tossing on the watery way,
All to the storm the unfettered sail devolve:
Man, more unwise, resigns the *mental* sway,
Borne headlong on by passion's keen resolve.
Beattie.

MENTHA, mint, in botany, a genus of the gymnospermia order, didynamia class of plants; natural order forty-second, verticillatæ: cor. nearly equal, and quadrifid, with one segment broader than the rest, and emarginated; the stamina are erect, standing asunder. There are many species, but not above three are cultivated for use; viz. 1. M. piperita, peppermint; 2. M. pulegium, pennyroyal; and, 3. M. viridis, common spearmint: all these are so well known as to need no description; and they are all very easily propagated by cuttings, parting the roots, or by off-sets.—For culinary purposes, the spearmint is preferable to the other two; but, for medicine, the peppermint and pennyroyal have in some places almost entirely superseded it. A conserve of the leaves is very grateful, and the distilled waters, both simple and spirituous, are universally thought pleasant. The leaves are used in spring salads; and the juice of them, boiled up with sugar, is formed into tablets. The virtues of mint are those of a warm stomachic and carminative: in loss of appetite, and nausea, there are few simples of equal efficacy. In colics, lienteries, and other immoderate fluxes, this plant frequently does good service. It likewise proves beneficial in many hysteric cases, and affords a useful cordial in languors and other weaknesses consequent upon delivery. The best preparation in these cases is a strong infusion of the dried herb in water which is much superior to the green, or rather a tincture or extract prepared with rectified spirit. These possess the whole virtues of the mint; the essential oil and distilled water contain only the aromatic part; the expressed juice only the astringency and bitterishness, together with the mucilaginous substance common to all vegetables. The peppermint is much more pungent than the others. Pennyroyal has the same general characters with mint, but is more acrid and less agreeable when taken into the stomach. It has long been held in great esteem as an aperient and deobstruent, particularly in hysteric complaints, and suppressions of the menses. For these purposes the distilled water is generally made use of, or, what is of equal efficacy, an infusion of the leaves.

MEN'TION, *n. s.* & *v. a.* Fr. *mention*, *mentionner*; Lat. *mentio*, a speaking of. Expression, oral or written; recital; hint: to express in words or writing.

MENTOR, son of Alcimus, the confidential friend of Ulysses, who intrusted to him the care of his domestic affairs, during his absence at the siege of Troy. The education of young Telemachus fell to his care, and when the prince set out in search of his father, Minerva accompanied him under the form of Mentor, as his counsellor and guide. From the development of this character in the Telemaque of Fenelon, the name Mentor is proverbially used to signify a wise and faithful monitor.

MENTZ, or MAYENCE, a strongly fortified city of the grand duchy of Hesse, and a bishop's see, is situated on the left bank of the Rhine, immediately below the confluence of the Maine with that river. It is built in the form of a semicircle, of which the Rhine is the base. Bastions with ravelins extend around the circumference; at the southern extremity is a citadel; at the northern two lunettes. On the south-west side are outworks of great strength, viz. six forts and a retrenched redoubt: most of them having casemates. On the north side, and beyond the glacis, are retrenchments thrown up in the latter half of the eighteenth century; and on the side of the river there is a bridge of boats, nearly half a mile in length, which crosses the Rhine to the village of Cassel, and is defended by a tete du pont. A little above this is an island formed by the Maine, and strongly fortified. On that river, about a mile above its junction with the Rhine, is the village of Costheim; and a little farther up a bridge of boats, defended by a strong tete du pont. These works require a garrison of nearly 30,000 men; but Mentz ranks, in consequence of them, as the strongest fortress in West Germany, if not in the whole empire.

Most of the streets of this old town are narrow, crooked, and gloomy, but some of the houses belonging to the great are spacious, and even stately. The buildings worth notice are, the electoral palace, now used as a military hospital, and greatly decayed; the house of the Teutonic knights, and the arsenal, all situated on the Rhine; and the houses of the Bassenheim, Stadion, Ostein, and Elz families. The dom or cathedral was built in the twelfth century; the church of St. Ignatius is a model of architecture, and ornamented with good ceiling paintings.

the ancient church of St. Stephen commands a fine view from the steeple. The public library has a collection of 80,000 volumes; cabinets of coins, medals, and natural history; a good collection of philosophical instruments; a fine museum of Roman monuments, and a picture gallery. Here are also a seminary, lyceum, and schools for medicine, midwifery, and the veterinary art.

The Eichelstein, a Roman monument, at a little distance from the town, is said to have been erected in honor of Drusus. It is now a mere ruin. Near Zahlbach, in this vicinity, is a Roman aqueduct; and along the banks of the Rhine a beautiful parade, and a quay or harbour for landing goods. The chief attraction of Mentz and its environs are the beautiful prospects to the south and west. Its trade in wines (French and Rhenish), and in general commission business connected with the navigation, is considerable, and largely conducted by Jews. Its manufacturing establishments are of small extent. The chief are cotton and coffee of chicory. Population 25,000.

The ancient and modern history of this city are alike interesting. Here Marcus Agrippa established an entrenched camp to oppose the German nations who menaced Gaul; and some time after Drusus Germanicus erected here a fort called Moguntiacum, and another on the opposite bank of the Rhine. Moguntiacum was extended, till the great struggles between the Romans and Germans checked its prosperity, but it traces its restoration to Charlemagne, who erected here a metropolitan church. Trade first beginning to thrive on the Rhine in the thirteenth century, the magistracy of Mentz and the neighbouring towns formed an association similar to that of the Hanse Towns. It took the name of the Rhenish confederation, and acted with vigor, so that the castles of the banditti of the neighbourhood were burned, and several of their ruins are still seen. In the fourteenth century Mentz was a place of some literary and scientific note. It was taken by the Swedes in the thirty years' war, and in 1688 by the French. In 1792 it surrendered to the French; next year the Austrians bombarded it, and in a siege of three months a great part of the houses were burned down. In 1797 it again came into possession of the French, and by the peace of Luneville (February 1801), was formally ceded to them. In 1802 the archbishopric was suppressed; but at the final settlement of Europe it was given to Hesse. It is thirty-seven miles south-east of Coblentz, and ninety-nine north by east of Strasburg.

MENTZEL (Christian), a native of Furstenwald, in Brandenburg, celebrated for his skill in medicine and botany, in pursuit of which he travelled through many countries. He died, A.D. 1701, about the seventy-ninth year of his age. He was a member of the academy des Curieux de la Nature. His works are, 1. Index Nominum Plantarum, printed at Berlin, in folio, 1696; and reprinted with additions in 1715, under the title of Lexicon Plantarum Polyglotton Universale. 2. A Chronology of China, in German; Berlin, 1696, in 4to. The following MSS. of his composition are preserved in the royal library at Berlin. 1. Sur l' Histoire Naturelle du Brasil, 4 vols. folio. 2. Sur les Fleurs et les Plantes du Japon, with colored drawings, 2 vols. folio.

MENUF, or MENOUF, a city of Lower Egypt, the capital of the district Menufyeh. It is situated on the side of a canal, which has ceased to be navigable; and at three leagues from the town a strong dyke has been made across it, for the purpose of preventing the too copious influx of water. Twenty-two miles N.N.W. of Cairo.

MENU, the name of a celebrated code of Hindoo laws, called after one of the fourteen mystical personages of that name. It is also called *Manava Dherma Sastra*, and is attributed to the first Menu, or Swayambhoura.

MENUTHIAS, or MENUTHIASDE, in ancient geography, an island adjoining to the north-east of the promontory Prasum of Ethiopia, beyond Egypt. Some take it to be Madagascar, or the island St. Laurence. Isaac Vossius will have it to be Zanzibar, Madagascar being at a greater distance from the continent than the ancients ever sailed to, whereas Menuthias was nearer; yet, though Zanzibar be nearer the continent, it is nearer the equator than Ptolemy's Menuthias, placed in lat. 12° 30′ S.

MENYANTHES, marsh trefoil, or buckbean, a genus of the monogynia order, and pentandria class of plants; natural order twenty-first, preciæ: COR. hairy; stigma bifid: CAPS. unilocular. This plant grows wild in moist marshy places in many parts of Britain. It has three oval leaves standing together upon one pedicle, which issues from the root; their taste is very bitter, and somewhat nauseous. Mr. Lightfoot says, the flowers are so extremely beautiful, that nothing but the requisite marshy soil could exclude it from a place in every garden. They grow in an elegant spike; are white, dashed with pink, and fringed internally with hairs. The Highlanders esteem an infusion of the leaves a good stomachic. Dr. Withering prescribes it in rheumatisms and dropsies; a drachm of them in powder destroys worms. In a scarcity of hops, this plant is used as a substitute in the north of Europe. The powdered roots are sometimes used in Lapland instead of bread, but they are unpalatable. From the Upsal Experiments it appears that, though goats eat it, sheep often will not. Cows, horses, and swine, refuse it.—Dr. Lewis recommends it, as an efficacious aperient, deobstruent, and gentle laxative. It has great reputation in scurvy and scrofula. Inveterate cutaneous diseases have been removed by an infusion of the leaves, drunk to the quantity of a pint a day, at proper intervals, and continued for some weeks. Boerhaave relates, that he was relieved of the gout by the juice mixed with whey.

MANZALEH, a large lake of Lower Egypt, extending eastward along the coast from the Damietta branch of the Nile. The French general Andreossy thinks it occupies the space formerly traversed by the Tanitic, Mendesian, and Pelusiac branches of the Nile, and has been formed out of them. It is about sixty miles in length, and twenty-five in extreme breadth, being

divided by a peninsula into two large gulfs, and the whole separated from the sea by a long and narrow tongue of land. The general depth is about five fathoms, but in some parts it is double, and even much greater. The water, which is phosphoric, is less salt than that of the sea; and in some places, during the inundation, may even be drunk. The lake abounds in fish, and in the entrance porpoises are found. It communicates with the sea only by two practicable mouths, those of Dybey and Omm Faredge, supposed to be the ancient Mendesian, and Tanitic mouth of the Nile. There is a considerable number of uninhabited islands on it. Some of them are covered with ruins however. The fishermen on the lake, and the Bedouins who inhabit the surrounding villages, are remarkably barbarous and ignorant.

MENZIKOFF (Alexander), a Russian prince, originally an apprentice to a pastry-cook near the palace of Moscow. By a fortunate circumstance he was, in early life, placed in the household of Peter the Great. Having made himself master of several languages, he first rendered himself agreeable, and afterwards became necessary to his master. He assisted Peter in all his projects; and was rewarded with the government of Ingria, the rank of prince, and the title of major-general. He signalised himself in Poland in 1708 and 1709; but in 1713 he was accused of embezzling the public money, and fined 300,000 crowns. The czar remitted the fine, and, having restored him to favor, gave him the command of an army in the Ukraine in 1719, and sent him as his ambassador into Poland in 1722. Constantly employed in endeavouring to preserve his influence after the death of his master, who was then evidently on the decline, Menzikoff discovered the person to whom the czar intended to leave the succession. The emperor was highly offended, and his penetration cost him the principality of Plescoff; and, on the death of the czar, in 1725, he was active in bringing different parties in Russia to agree to the succession of Catharine, under whom he enjoyed continued favor. This princess was not ungrateful. In appointing her son-in-law Peter II. to be her successor, she commanded him to marry the daughter of Menzikoff, and gave the czar's sister to his son. The parties were actually betrothed, and Menzikoff was made duke of Cozel and grand steward to the czar. But this summit of elevation was the prelude to his fall. The Dolgoroukis, favorites of the czar, had the influence to procure his banishment, together with that of his family, to one of his own estates, at the distance of 250 leagues from Moscow. But, having the imprudence to leave the capital with great parade, a party of soldiers was sent after him, who reduced him to the rank and dress of a peasant, and carried him and his family in waggons to Siberia; where, after losing his wife on the journey, and one of his daughters, he died November 2, 1729. His surviving son and daughter, after seeing their persecutor Dolgorouki degraded and banished to the same inhospitable climate, were recalled to Moscow by the empress Ann; and left Dolgorouki in possession of their cottage. Young Menzikoff was made captain of the guards, and received the fifth part of his father's possessions.

MENZINI (Benedict), a celebrated Italian poet, born in Florence. He was professor of eloquence at the college of Sapienza at Rome, where he died in 1704. He wrote, 1. The Art of Poetry. 2. Satires, Elegies, Hymns, and the Lamentations of Jeremiah. 3. Academia Tusculana, a work in verse and prose, which is his masterpiece.

MEPHITIC, or MEPHITICAL, a word applied to any kind of noxious vapor; but generally to that species of gas called carbonic acid gas. See CHEMISTRY.

MEPHIT'ICAL, *adj.* Lat. *mephitis.* Ill-savored; stinking.

Mephitical exhalations are poisonous or noxious steams issuing out of the earth, from what cause soever.

MEPHITIS, the name of the goddess who presided over the pestilential vapors, and was worshipped in ancient Italy, particularly at Cremona, and by the Hirpini. See AMPSANCTI.

MEQUINEZ, a city of Morocco, the frequent residence of the emperors, is situated in a fine plain, watered by numerous rivulets, and surrounded with a wall six feet high. Muley Ismael resolved to make it the capital of his northern dominions, considerably enlarged the city, and erected a beautiful palace. The Brebers of the mountains often make incursions even to its gates. The seraglio occupies an immense quadrangular space, being built only upon the ground floor; the rooms are long and narrow, and the light is communicated only by folding doors. About 100 years ago a convent was founded here by the kings of Spain. Long. 5° 50′ W., lat. 33° 56′ N.

MER'CABLE, *adj.*
MER'CANTANT, *n. s.*
MER'CANTILE, *adj.*
MER'CAT, *n. s.*
MER'CATURE.

Lat. *mercor, merx, mercatus, mercatura.* To be bought or sold: mercantant seems used in a cant way by Shakspeare, after the Ital. *mercatante*, to signify a foreign merchant or trader: mercantile is commercial; relating to trade or commerce: mercat, an obsolete name for a market, or place of resort for trade: mercature, which we only find in Dr. Johnson, the practice of buying and selling.

MERCANTILE SYSTEM, in political economy is one that prevails to a greater or less extent in every country of Europe. It was introduced in France by Colbert. (q. v.) As originally understood and acted upon, it embraces some fallacious doctrines, and carries some just ones to excess. The notion, for example, that wealth is derived mostly from foreign commerce, and depends upon an annual importation of specie, called the balance of trade, is erroneous. This balance was understood to be the bullion or coin received by a country in exchange for a part of its exports, and the foreign trade was supposed to be advantageous and promotive of the national wealth in proportion as the returns of trade were made in the precious metals, instead of other merchandise, whereas an exchange for iron, tin, leather, or any other useful merchantable commodity, is quite as advantageous

as the importation of specie. It will depend upon the wants of the community whether the importation of one or another article will most promote the national wealth. It would be quite absurd, therefore, to attempt, by legislation, to force trade to yield a balance in specie. As far as this was a direct object of the commercial system, it was accordingly mistaken. If a nation needs other things more than specie, such prices will be offered as will induce their importation. But this notion of the importance of the balance of exports and imports is not without its truth in a certain respect. It is undoubtedly an evil for one nation to be constantly indebted to another. It will be found true between individuals, different districts of the same country, and also between different nations, that the indebted party is the one most liable to make sacrifices. If a people or district, or an individual, will keep in advance of their means, and anticipate the income of the coming year, the consequence will be a perpetually straitened and embarrassed state. This was always the case with the British American colonies, and even of the states for many years after the establishment of the American independence. The liberal credits in England enabled them to anticipate their income, and they were accordingly always largely indebted to England, and thus constantly straitened and distressed, notwithstanding the country was, during the same time, rapidly growing in population and wealth. It is desirable that the commerce of a country should be so conducted as not to keep the country constantly indebted. If we were, therefore, to consider the balance of trade to be a constant standing balance of debt due to, or from, a country, in this sense it would be a subject of great importance. The consequence of large foreign credits, and of the desire to consume more of foreign products than the people have present produce of their labor sufficient to pay for, is occasionally to drive specie from the country; and the more extensive the credits, the more complete and exhausting will be this drain when it happens. The only way of preventing its recurrence is to produce at home so great a proportion of the commodities wanted for consumption, that the exportable produce will be amply sufficient to pay, in the foreign markets, for the foreign products needed. But, whether legislation shall be at all, and if at all, to what extent, directed to the advancement of commerce, or any other branch of industry, so as incidentally and consequentially to affect the kind and amount of exchanges with foreign nations, are much agitated questions. The practice of the whole civilized world is to legislate with a reference to national industry, and such it always has been. The real ground of doubt seems to relate to the proper objects and extent of this legislation.

MERCARA, a town and fortress of the Mysore, Hindostan, and district of Coorg, of which it is the capital. It was built by Hyder Aly in 1773, after he had conquered the country, and taken prisoner the rajah. It was again besieged by the Coorgs in 1785, but without avail. By the treaty with Tippoo, in 1792, he was, however, compelled to relinquish Coorg in favor of the old family, which, since that period, has resided here.

MERCATOR (Gerard), one of the most celebrated geographers of his time, was born at Ruremonde in 1512. He applied himself with great industry to geography and mathematics. The emperor Charles V. had a particular esteem for him, and the duke of Juliers made him his cosmographer. He composed a chronology, some geographical tables, an atlas, &c., engraving and coloring the maps himself. He died in 1594. His method of laying down charts is still used. See MAPS.

MERCATOR (Nicholas), F. R. S., an eminent mathematician in the seventeenth century, born at Holstein. He came to England about 1660, where he lived many years. He endeavoured to reduce astrology to rational principles. He published several works, particularly Cosmographia. He gave the quadrature of the hyperbole by an infinite series; which was the first appearance in the learned world of a series of this sort drawn from the particular nature of the curve.

MERCATORUM FESTUM, a festival kept by the Roman merchants on the 15th of May in honor of Mercury, who presided over merchandise. A sow was sacrificed on the occasion, and the people present sprinkled themselves with water from the fountain called aqua Mercurii; the whole concluding with prayers to the god for the prosperity of trade.

MER'CENARY, *adj.&n.s.* } Fr. *mercenaire;*
MER'CENARINESS, *n. s.* } Lat. *mercenarius.*
Hired or bribed; corrupted by money; venal: a hireling: mercenariness is venality; undue respect to hire or pecuniary reward.

> He a poor *mercenary* serves for bread;
> For all his travel, only clothed and fed.
>
> *Sandys.*

MER'CER, *n. s.* } Fr. *mercier;* Ital. *mer-*
MER'CERY. } *ciaro;* of Lat. *merx, mercis,*
merchandise. A dealer in silks (as a superior kind of merchandise): mercery, the trade in silks.

> The draper and *mercer* may measure religion as they please, and the weaver cast her upon what loom he please.
>
> *Howel.*

> The *mercery* is gone from out of Lombard-street and Cheapside into Paternoster-row and Fleet-street
>
> *Graunt.*

MER'CHAND, *v. a.* } Fr. *marchand*
MER'CHANDISE, *n. s.* & *v. n.* } *marchandise.* It
MER'CHANT, *n. s.* } *mercanter, mer-*
MER'CHANTABLE, *adj.* } *cadentia;* Span.
MER'CHANTMAN, *n. s.* } *mercadina;* Port.
mercadoria; all of Lat. *merx, mercator.* To traffic; transact in trade; exercise commerce; this is the sense of both the verbs, which are however seldom used: merchandise, as a substantive, is traffic; commerce; wares bought or sold: a merchant, he who exercises that traffic; and sometimes a wholesale as distinct from a retail dealer: merchantable, marketable; in condition to be bought or sold: merchantman, a trading ship.

MERCHET, or MERCHETUM. See MARCHET. Anciently no baron, or military tenant, could marry his sole daughter and heir, without such

leave purchased from the king, pro maritanda filia. And many servile tenants could neither send their sons to school, nor give their daughters in marriage, without express leave from the superior lord.

MERCIA, one of the seven kingdoms founded in England by the Saxons. Though the latest formed, it was the largest of them all, and grew by degrees to be the most powerful. On the north it was bounded by the Humber and the Mersey, which separated it from Northumberland; and on the east by the sea, and the territories of the East Angles and Saxons; on the south by the Thames; and on the west by the Severn and Dee. It comprehended about seventeen modern counties, being equal in size to the province of Languedoc, very little less than the kingdom of Arragon, and superior in size to that of Bohemia. Penda was its first monarch; and the name is derived from the Saxon word merc, i. e. a march, bound, or limit, because the other kingdoms bordered upon it on every side; and not from the river Mersey, as some allege. Penda assumed the regal title A. D. 626, and was of the age of fifty at the time of his accession; after which he reigned nearly thirty years. He was of a most turbulent temper, differing occasionally with almost all his neighbours, calling in the Britons to his assistance, and shedding more Saxon blood than had been spilt in all their intestine quarrels. He slew two kings of Northumberland, three of the East Angles, and compelled Kenwall, king of the West Saxons, to quit his dominions. He was at length slain, with most of the princes of his family, and a multitude of his subjects, in a battle fought near Leeds by Osway king of Northumberland, A. D. 655. He had the year before killed Anna king of the East Angles in battle, whose brother Ethelred notwithstanding took part with Penda. On the other hand, Penda the eldest son of Penda, to whom his father had given the ancient kingdom of the Mid Angles, had two years before married the natural daughter of king Osway, and had been baptised at his court. But, after Penda had conquered the East Angles, he resolved to turn his arms against Northumberland. Osway, to prevent this rupture, offered large sums, and jewels of great value, to purchase peace; these offers being rejected, he was reduced to the necessity of deciding the quarrel by the sword. The river near which the battle was fought overflowing, there were more drowned than killed. Amongst these, as the Saxon Chronicle informs us, there were thirty princes of the royal line, some of whom bore the title of kings; and also Ethelred king of the East Angles, who fought on the side of Penda, against his family and country. His son Penda, who had married Osway's daughter, became a Christian, and was not long after murdered by the malice of his mother. His brother Wolfher becoming king, embraced the Christian faith, and proved a very victorious and potent monarch; and is commonly styled king of the Anglo-Saxons, as also are seven of his immediate successors, though none of them are known by that title in the Saxon Chronicle. The extent of the Mercian territories was so ample as to admit, and so situated as to require, subordinate rulers in several provinces; who, if they were of the royal line, had the title of king; which occasions some confusion in their history. Besides establishing episcopal sees and convents, the Saxon monarchs improved and adorned their dominions otherwise, and Mercia was greatly improved. Coventry, being situated in the centre, was usually the royal residence. Penda, who was almost continually in a state of war, lived, as his military operations directed, in some great town on the frontiers. Wolfher built a castle or fortified palace for his own residence, which bore his name. Offa kept his court at Sutton Walls, near Hereford. In each of the provinces there resided a chief magistrate; who, if of the royal blood, had the title of king. Penda, when he married Osway's daughter, had the title of king of Leicester. Ethelred made his brother Merowald king of Hereford; who, dying without issue, bequeathed it to his younger brother Mercelm. The like honors were sometimes conferred upon the princesses; and hence we occasionally read of vice-queens. By these means the laws were better executed, the obedience of the subjects more effectually secured, and the splendor of these residences constantly kept up and augmented. At length, the crown devolving sometimes on minors, and sometimes on weak princes, intestine factions also prevailing, the strength of this hitherto mighty kingdom began to decline. Egbert, the most prudent and most potent monarch of th West Saxons, took advantage of these circumstances; and, having encouraged the East Angles to attempt the recovery of their independence, he attacked the Mercians, and after a short war obliged them to submit. But this was not an absolute conquest, the kings of Mercia being allowed by him and his successors to retain their titles and dominions, till the invasion of the Danes put an end to their rule; and, when the Danes were afterwards expelled by the West Saxons, it sunk into a province, or rather was divided into many.

MERCURIALIS (Jerom), an eminent Italian physician, born at Forli in 1530, where he first practised; but was afterwards professor of medicine successively at Padua, Bologna, and Pisa. His writings on physic are very numerous; besides giving an edition of Hippocrates in Greek and Latin, with notes. He died in 1606; and in 1644 some select pieces of his were published at Venice in one volume folio.

Mercurialis, mercury, in botany, a genus of the enneandria order, and diœcia class of plants. natural order thirty-eighth, tricoccæ. Male cal. tripartite: cor. none; but nine or twelve stamina; the anthera globular and twin. Female cal. tripartite: cor. none, but two styles: caps. bicoccous, bilocular, and monospermous. There are several species:

1. M. annua, or French mercury, with spiked flowers, male and female. This is an annual plant, with a branching stalk about a foot high, garnished with spear-shaped leaves of a pale or yellowish-green color. The male plants have spikes of herbaceous flowers growing on the top of the stalks: these fall off soon; but the female plants, which have testiculated flowers

proceeding from the side of the stalks, are succeeded by seeds, which, if permitted to scatter, will produce plenty of plants of both sexes.

2. M. perennis, mountain, or dog's mercury, with spiked or testiculated flowers, grows under hedges and in woods in many parts of Britain. It has a perennial root, which creeps in the ground; the stalks are single, and without branches, rising ten or twelve inches high, garnished with rough leaves, placed by pairs at each joint, of a dark green color, indented on their edges; these have their male flowers growing in spikes, upon different plants from those which produce seeds. This species is of a soporific deleterious nature, noxious both to man and beast. Some have eaten it by mistake instead of English mercury, and have thereby slept their last. In the isle of Skye it is called lusglen bracadale; and an infusion of it is sometimes taken to bring on a salivation.

3. M. tomentosa, or shrubby hairy mercury, is a native of the South of France, Spain, and Italy. It has a shrubby branching stalk, growing a foot and a half high, garnished with oval leaves placed by pairs, and covered with a white down on both sides. The male flowers grow in short spikes from the side of the stalks upon different plants from the first. All the species are easily propagated by seeds.

MER'CURY, *n. s.* Lat. *mercurialis*. A plant.

Herb *mercury* is of an emollient nature, and is eaten in the manner of spinach, which, when cultivated in a garden, it greatly excels. *Hill.*

MER'CURY, *n. s.* } Lat. *Mercurius, mer-*
MERCURIFICA'TION, } *curialis*; from the nim-
MERCU'RIAL, *adj.* } ble deity of this name.
Quicksilver, see below: also, metaphorically, agility; sprightly qualities: mercurification, the act of mixing any thing with mercury: mercurial, formed of mercury; under the influence or operation of mercury; active; sprightly.

I know the shape of 's leg: this is his hand,
His foot *mercurial*, his martial thigh,
The brawns of Hercules. *Shakspeare. Cymbeline.*

This youth was such a *mercurial*, as could make his own part, if at any time he chanced to be out. *Bacon's Henry VII.*

I add the ways of *mercurification*. *Boyle.*

The gall of animals and *mercury* kill worms; and the water in which *mercury* is boiled has this effect. *Arbuthnot.*

Thus the *mercury* of man is fixed,
Strong grows the virtue with his nature mixed;
The dross cements what else were too refined,
And in one interest body acts with mind. *Pope.*

Tully considered the dispositions of a sincere, more ignorant, and less *mercurial* nation, by dwelling on the pathetick part. *Swift.*

MERCURY, or quicksilver, in chemistry, may be distinguished from all other metals by its extreme fusibility. It does not take the solid state until cooled to the thirty-ninth degree below zero of Fahrenheit, and is of course therefore always fluid in the temperate climates of the earth. Its color is white and rather bluer than silver: its specific gravity 13·6. When solid it is malleable; but, at the common temperature of our earth, volatile and evaporating in a slight degree. At a heat of about 656° it boils rapidly, and rises in dense copious fumes. The following is a list of its principal ores, as arranged by Jamieson.

Species I. *Native mercury.*

1. *Fluid mercury.* It occurs principally in rocks of the coal formation, associated with cinnabar, corneous mercury, &c. Small veins of it are rarely met with in primitive rocks, accompanied with native silver, &c. It is found at Idria in the Friaul; Niderslana in Upper Hungary; in the Palatinate; Deux Ponts, &c.

2. *Dodecahedral mercury, or native amalgam,* divided into, *a, fluid or semi-fluid amalgam.* Color tin-white. In roundish portions; and crystallised in a rhomboidal dodecahedron, rarely perfect. Splendent. When cut it emits a creaking sound. As hard as talc. Specific gravity 10·5. Its constituents are, mercury 74, silver 25. It is found at Deux Ponts; and *β, solid amalgam.* Color silver-white. Massive and disseminated. Fracture flat conchoidal. As hard as gypsum. Brittle. Creaks strongly when cut. Specific gravity 10·5. The mercury flies off before the blow-pipe. Its constituents are, mercury 74, silver 25.—Heyer. Mercury 64, silver, 36.—Klaproth. It is found in Hungary, the Deux Ponts, &c.

Species II. *Cinnabar,* or *prismato-rhomboidal ruby-blende.*

1. *Dark red cinnabar.* Color cochineal-red. Massive, disseminated, imitative, and crystallised. Primitive form a rhomboid. Secondary forms, a regular six-sided prism, an acute rhomboid, and a six-sided table. Splendent, adamantine. Translucent. Streak scarlet-red, shining. Harder than gypsum. Sectile and easily frangible. Specific gravity 6·7 to 8·2. It melts, and is volatilised with a blue flame and sulphureous odor. Its constituents are, mercury 85·5, sulphur 14·75. —Klaproth.

2. *Bright red cinnabar.*—Color bright scarlet red. Massive, and in delicate fibrous concretions. Glimmering and pearly. Fracture earthy. Opaque. Streak shining. Soils. Friable. It occurs in rocks of clay-slate, talc-slate, and chlorite-slate; in veins at Horzowitz in Bohemia; at Idria, &c.

3. *Hepatic cinnabar,* divided into, *a, compact.* Color between cochineal-red and dark lead-gray. Massive. Glimmering and semi-metallic. Streak shining. Opaque. Soft. Sectile. Specific gravity 7·2. Its constituents are, mercury 81·8 sulphur 13·75, carbon 2·3, silica 0·65, alumina 0·55, oxide of iron 0·2, copper 0·02, water 0·73 *β, slaty mercurial hepatic ore.* Color as above, but sometimes approaching to black. Massive, and in roundish concretions. Lustre shining, semi-metallic. Fracture curved slaty. Most easily frangible. Streak cochineal-red, inclining to brown. Rather lighter than the compact. It occurs in considerable masses in slate-clay and bituminous shale. It is most abundant in Idria.

Species III. *Corneous mercury,* or *horn quicksilver.*

Pyramidal corneous mercury. Color ash-gray. Vesicular, with interior crystallisations, which are, a rectangular four-sided prism, variously acuminated, and a double four-sided pyramid. Crystals very minute. Shining, adamantine. Cleavage single. Faintly translucent. Soft.

Sectile and easily frangible. It is totally volatilised before the blow-pipe, with a garlic smell. It is soluble in water, and the solution mixed with lime water gives an orange-colored precipitate. Its constituents are, oxide of mercury 76, muriatic acid 16·4, sulphuric acid 7·6.—Klaproth. It occurs in Bohemia, &c.

Mercury is not perceptibly altered by mere exposure to the air; though by long agitation, with access of air, it becomes converted into a black powder or oxide, which gives out oxygen by heat, the metal being at the same time revived.

When calomel or protochloride of mercury is acted on by potash-water, it yields the pure black protoxide; and, when corrosive sublimate or the deutochloride is treated in the same way, it affords the red deutoxide. The former oxide, heated with access of air, slowly changes into the latter. The constituents of the first are 100 metal + 4 oxygen; of the second 100 + 8. Hence the prime equivalent of mercury is 25. At a red heat both oxides emit their oxygen, and pass to the metallic state. A moderate heat converts the black oxide partly into running mercury and partly into red oxide. The deutoxide, as usually prepared from the nitrate by gentle calcination, is in brilliant red scales, which become of an orange hue when finely comminuted. It frequently contains a little undecomposed subnitrate.

By triturating mercury with unctuous or viscid matters it is changed partly into protoxide, and partly into very minute globules. By exposing mercurial ointment to a moderate heat, the globules fall down, while a proportion of the oxide remains combined with the grease. This light gray chemical compound is supposed to possess all the virtues of the dark-colored ointment, and to be cheaper and more convenient in the application.

Red oxide of mercury is acrid and poisonous, and carries these qualities into its saline combinations. The protoxide is relatively bland, and is the basis of all the mild mercurial medicines.

1. When mercury is heated in chlorine it burns with a pale red flame, and the substance called corrosive sublimate is formed. This deutochloride may also be formed by mixing together equal parts of dry bideuto-sulphate of mercury and common salt, and subliming. The corrosive sublimate rises, and incrusts the top of the vessel, in the form of a beautiful white semi-transparent mass, composed of very small prismatic needles. It may be obtained in cubes, and rhomboidal prisms, or quadrangular prisms, with their sides alternately narrower, and terminated by dihedral summits. Its specific gravity is 5·14. Its taste is acrid, stypto-metallic, and eminently disagreeable. It is a deadly poison. Twenty parts of cold water dissolve it, and less than one of boiling water: 100 parts of alcohol at the boiling temperature dissolve 88 of corrosive sublimate; and at 70° they dissolve 37·5 parts. The constituents of this chloride are,—

Mercury,	25 . . .	73·53
Chlorine,	9 . . .	26·47

It may be recognised by the following characters:—it volatilises in white fumes, which seem to tarnish a bright copper-plate, but really communicate a coating of metallic mercury, which appears glossy white on friction. When caustic potash is made to act on it, with heat, in a glass tube, a red color appears, which by gentle ignition vanishes, and metallic mercury is then found to line the upper part of the tube in minute globules. Solution of corrosive sublimate reddens litmus paper, but changes syrup of violets to green. Bicarbonate of potash throws down from it a deep brick-red precipitate, from which metallic mercury may be procured by heating it in a tube. Caustic potash gives a yellow precipitate; but, if the solution be very dilute, a white cloud only is occasioned, which becomes yellowish-red on subsidence. Lime water causes a deep yellow, verging on red. Water of ammonia forms a white precipitate, which becomes yellow on being heated. With sulphureted hydrogen and hydrosulphurets, a black, or blackish-brown, precipitate appears. Nitrate of silver throws down the curdy precipitate characteristic of muriatic acid; and the protomuriate of tin gives a white precipitate. The proper antidote to the poison of corrosive sublimate is the white of egg, or albumen, which converts it into calomel. Sulphureted hydrogen water may also be employed, along with emetics. From six to twelve grains were the mortal doses employed by Orfila in his experiments on dogs. They died in horrible convulsions, generally in two hours. But when, with the larger quantity, the whites of eight eggs were thrown into the stomach, the animals soon recovered, after vomiting. Corrosive sublimate, digested with albumen for some time, was given in considerable doses with impunity.

2. Protochloride of mercury, mercurius dulcis, or calomel, is usually formed from the deutochloride, by triturating four parts of the latter with three of quicksilver, till the globules disappear, and subjecting the mixture to a subliming heat. By levigating and edulcorating with warm water the sublimed grayish-white cake, the portion of soluble corrosive sublimate which had escaped decomposition is removed. It may also be made by adding solution of protonitrate of mercury to solution of common salt. The protochloride or calomel precipitates. The following is the process used at Apothecaries' Hall, London:—50 lbs. of mercury are boiled with 70 lbs. of sulphuric acid, to dryness, in a cast iron vessel; 62 lbs. of the dry salt are triturated with 40½ lbs. of mercury, until the globules disappear, and 34 lbs. of common salt are then added. This mixture is submitted to heat in earthen vessels, and from 95 to 100 lbs. of calomel are the result. It is washed in large quantities of distilled water, after having been ground to a fine and impalpable powder.

When protochloride of mercury is very slowly sublimed, four-sided prisms, terminated by pyramids, are obtained. It is nearly tasteless and insoluble, and is purgative in doses of five or six grains. Its specific gravity is 7·176. Exposure to air darkens its surface. When two pieces are rubbed in the dark they phosphoresce. It is not so volatile as the deutochloride. Nitric acid dissolves calomel, converting it into corro-

sive sublimate. Protochloride of mercury is composed of

Mercury,	25·	84·746
Chlorine,	4·5	15·254

We have also two sulphurets of mercury; the black or ethiops mineral, and the red or cinnabar.

MERCURY, MERCURIUS, in the heathen mythology. Most of the actions and inventions of the Egyptian Hermes have been ascribed to the Grecian Mercury, the son of Jupiter, and Maia the daughter of Atlas. No one of all the heathen divinities had so many functions allotted to him as this god: he had constant employment both day and night, having been the common minister and messenger of all Olympus; particularly of his father Jupiter, whom he served with indefatigable labor, and sometimes indeed in a capacity of no very honorable kind. Lucian is very pleasant upon the multitude of his avocations; and, according to the emperor Julian, Mercury was no hero, but rather one who inspired mankind with wit, learning, and the ornamental arts of life, than with courage. He was also the patron of trade, and even of fraud and theft. Amphion is said, by Pausanias, to have been the first that erected an altar to this god; who, in return, invested him with such extraordinary powers of music (and masonry), as to enable him to fortify the city of Thebes, by the mere sound of his lyre. See AMPHION. Horace gives us the best account of his character, in his tenth Ode, lib. 1, which contains the substance of a long hymn to Mercury, attributed to Homer. His most magnificent temple was on mount Cylene, in Arcadia. He is described by the poets as a fair beardless youth, with flaxen hair, lively blue eyes, and a smiling countenance. He has wings fixed to his cap and sandals, and holds the caduceus in his hand (see CADUCEUS); and is frequently represented with a purse to show that he was the god of gain. The animals sacred to him were the dog, the goat, and the cock. In all the sacrifices offered to him, the tongues of the victims were burnt; and those who escaped imminent danger sacrificed to him a calf, with milk and honey.

MERCURY, ☿, in astronomy. See ASTRONOMY. This planet is brightest between his elongations and superior conjunction, very near to which last he can generally be seen. He becomes invisible soon after he has found his elongation, going towards his inferior conjunction; and becomes visible again a few days before his next elongation. The brightness of this planet alters sometimes very considerably in twenty-four hours. It has been observed when less than three degrees distant from the sun, and may, perhaps, sometimes be seen even in conjunction with it. Mercury and Venus appear brightest and most beautiful in the opposite parts of their orbits; the first between his elongations and superior conjunction, and the other between her elongation and inferior conjunction. Therefore Venus is seen in great perfection as a crescent, particularly in her inferior conjunction, whilst mercury is seldom seen in such perfect phases. Mercury should be always observed on or near the meridian. When farthest from the sun, he always appears with a very faint light; and when he has a great south declination, or the atmosphere is not perfectly clear, he seldom can be seen in those parts of his orbit where he only begins to recover his brightness, or where it is much diminished. He has frequently been seen on the meridian, even with a small telescope and small power.

MERCURY, in heraldry, a term used in blazoning by planets, for the purple color used in the arms of sovereign princes.

MERCURY BAY, a convenient bay on the north-east coast of the northernmost island of New Zealand, thus named by captain Cook, who observed here the transit of Mercury over the sun in 1769. It has abundance of wood and water; and in one of its rivers is an immense quantity of oysters. Long. 184° 4′ W., lat. 36° 48′ S.

MER'CY, *n. s.*
MER'CIABLE, *adj.*
MER'CIFUL, *adj.*
MER'CIFULLY, *adv.*
MER'CIFULNESS, *n. s.*
MER'CILESS, *adj.*
MER'CILESSLY, *adv.*
MER'CY-SEAT, *n. s.*

Fr. *merci*; Ital. *merce*, *misericordia*; Span. and Port. *misericordia*, of Lat. *misericordia*. Compassion; tenderness; clemency; unwillingness to punish; pardon; and, as mercy is supposed to be free, discretion; power to act, or refrain from acting, at pleasure: merciable is used by Spenser for merciful, which signifies compassionate; disposed to spare or pardon; or to kind services; the adverb and noun following, corresponding: merciless, without mercy; pitiless; severe; hard-hearted: mercilessly, in a ruthless or hard-hearted manner: mercy-seat, a peculiar part of the Jewish ark, and a name of our Lord Jesus Christ in the New Testament. See the following article.

Therfore be ye *merciful* as youre fadir is merciful. *Wiclif. Luk.* vi.

Make a *mercy-seat* of pure gold. *Exod.* xxv. 17.

Be *merciful*, O Lord, unto thy people thou hast redeemed. *Deut.* xxi. 8.

He shall have judgment without *mercy* that hath shewed no *mercy*. *St. James.*

The hand that ought to knit all these excellencies together is a kind *mercifulness* to such a one, as is in his soul devoted to such perfections. *Sidney.*

His mother *merciless*,
Most *merciless* of women Wyden hight,
Her other son fast sleeping did oppress,
And with most cruel hand him murdered pitiless. *Spenser.*

Nought but well mought him betight:
He is so meek, wise, *merciable*,
And with his word his work is convenable. *Id.*

'Twere a paper lost,
As offered *mercy* is. *Shakspeare. Cymbeline.*

The foe is *merciless*, and will not pity. *Shakspeare.*

Mercy is not strained;
It droppeth, as the gentle rain from heaven,
Upon the place beneath. It is twice blessed;
It blesseth him that gives and him that takes. *Id.*

Condition!
What good condition can a treaty find
I' the part that is at *mercy*? *Id. Coriolanus.*

Examples of justice must be made for terror to some; examples of *mercy* for comfort to others: the one procures fear, and the other love. *Bacon.*

Think not their rage so desperate to essay
An element more *merciless* than they. *Denham.*

Miserable men commiserate not themselves; bowelless unto others, and *merciless* unto their own bowels.
Browne.

Observe
His providence, and on him sole depend,
Merciful over all his works; with good
Still overcoming evil. *Milton.*

Good heaven, whose darling attribute we find
Is boundless grace, and *mercy* to mankind,
Abhors the cruel. *Dryden.*

What god so mean,
So *merciless* a tyrant to obey! *Id. Juvenal.*

Make the true use of those afflictions which his hand, *mercifully* severe, hath been pleased to lay upon thee. *Atterbury.*

We adore his undeserved *mercy* towards us, that he made us the chief of the visible creation.
Bentley's Sermons.

Use the means ordinary and lawful, among which *mercifulness* and liberality is one, to which the promise of secular wealth is most frequently made.
Hammond.

The most authentick record of so ancient a family should lie at the *mercy* of every infant who flings a stone. *Pope.*

Whatever ravages a *merciless* distemper may commit, she shall have one man as much her admirer as ever. *Id.*

A lover is ever complaining of cruelty while any thing is denied him; and, when the lady ceases to be cruel, she is, from the next moment, at his *mercy*.
Swift.

The torrent *merciless* imbibes
Commissions, perquisites, and bribes. *Id.*

The *mercy-seat* was the covering of the ark of the covenant, in which the tables of the law were deposited: it was of gold, and at its two ends were fixed the two cherubims, of the same metal, which, with their wings extended forwards, seemed to form a throne for the majesty of God, who in scripture is represented as sitting between the cherubims, and the ark was his footstool: it was from hence that God gave his oracles to Moses, or to the high-priest that consulted him. *Calmet.*

Seeds of *merciless* disease
Lurk in all that we enjoy;
Some that waste us by degrees,
Some that suddenly destroy. *Cowper.*

The MERCY-SEAT, or Propitiatory, in the Jewish tabernacle and temple, was strictly, not the covering of the ark, but the basis of the throne or standing-place of the cherubim. The latter are said to be made 'of,' as well as 'in the ends of the mercy-seat.' Whether the ark or chest beneath had or had not a distinct lid or cover seems doubtful.

The LXX., render the term כפרת, Exod. xxv. 17, by *ἱλαστηριον επιθεμα*, a propitiatory lid or covering, but generally by *ἱλαστηριον* alone, a propitiatory, which St. Paul calls it, Heb. ix. 5, and which he uses as a name of Christ, Rom. iii. 25. Our common version calling him in the latter place the 'propitiation for our sins,' states a most important truth, but not the truth of the original, which means to say that, in the character and work of Jesus Christ, is a constant seat or throne of mercy at which guilty men should apply. See Parkhurst, Locke, and Whitby, on the place.

MERDIN, a city of Diarbekir, the ancient Marde, Asiatic Turkey, is situated near the summit of a lofty mountain, on which is a castle. The town is difficult of access, being ascended on the north side only by a narrow winding pathway, and on the south by a road of a mile and a half in length very steep. Notwithstanding its situation it is well supplied with water, and the houses are built of very fine hewn stone, but have grated iron windows. The population, 11,000, are Arminians, Jews, Turks, Arabs, and Curds; the first being the largest in number. The walls are kept in repair; and a few old pieces of cannon are mounted on the castle. It is forty-five miles south of Diarbekir.

MERE, *adj.* } Lat. *merus*; Gr. *μειρω*.
MERE'LY, *adv.* } Sole; pure; plain; very; that or this only: merely, simply; only; thus and in no other manner.

Which thing we ourselves would grant, if the use thereof had been *merely* and only mystical.
Hooker.

Scotland hath foisons to fill up your will
Of your *mere* own. *Shakspeare. Macbeth.*
These external manners of laments
Are *merely* shadows to the unseen grief,
That swells with silence in the tortured soul.
Shakspeare.

As for conflagrations and great droughts, they do not *merely* dispeople, but destroy. *Bacon.*

The *mere* Irish were not admitted to the benefit of the laws of England, until they had purchased charters of denization. *Davies on Ireland.*

It is below reasonable creatures to be conversant in such diversions as are *merely* innocent, and have nothing else to recommend them. *Addison.*

From *mere* success nothing can be concluded in favour of any nation upon whom it is bestowed.
Atterbury.

What if the head, the eye, or ear repined,
To serve *mere* engines to the ruling mind. *Pope.*

Prize not your life for other ends
Than *merely* to oblige your friends. *Swift.*

Let eastern tyrants from the light of heaven
Seclude their bosom slaves, meanly possessed
Of a *mere*, lifeless, violated form.
Thomson's Spring.

MERE, *n. s.* Sax. mepe. A pool, or lake or boundary. See MEER.

Meres stored both with fish and fowl.
Camden.

The mislayer of a *mere* stone is to blame: but it is the unjust judge that is the capital remover of land-marks, who defineth amiss of lands. *Bacon.*

MERE (George Brossin Chevalier de), a French writer of the seventeenth century. He published, 1. Discourses on Wit and Conversation; 2. The Elegancies of Discourse; 3. Treatises on Politeness, Eloquence, and Speech; 4. Letters, &c. He died at his seat, in Poitou, in 1690.

MERETRIC'IOUS, *adj.* } Lat. *meretricius*,
MERETRI'CIOUSLY, *adv.* } *meretrix*. Shewy; fallacious; alluring by false show; practised by prostitutes.

Our degenerate understandings have suffered a sad divorce from their dearest object, defile themselves with every *meretricious* semblance, that the variety of opinion presents them with.
Glanville's Scepsis.

Not by affected, *meretricious* arts,
But strict harmonious symmetry of parts.
Roscommon.

By happy alchemy of mind,
They turn to pleasure all they find:
They both disdain in outward mien
The grave and solemn garb of spleen,
And *meretricious* arts of dress
To feign a joy and hide distress. *Green.*

No *meretricious* graces to beguile,
No clustering ornaments to clog the pile.
Cowper.

MERETRIX, among the Romans, differed from the prostibula. The prostibulæ were common courtezans, with bills over their doors signifying their profession, and were ready at all times to receive persons; whereas the meretrices entertained none but at night. The meretrices differed in their dress from the matrons; the former wore the toga and short tunics, like those of the men; the latter wore the pulla and the stola of such a length as to reach to their feet.

MERGUI, a sea-port town of Lower Siam, in the Birman empire, was taken from the Siamese by the Birmans in 1759, and has remained in their possession ever since. It is situated favorably for commerce, about six miles up the Tannaserim River; middling sized vessels may go up to the town. The principal articles of export are ivory, tutenague, rice, and other provisions; French privateers during the war, used to anchor at King's Island, off the mouth of the river, and were there supplied by the boats of the natives. A number of Mahometans are settled at Mergui, and the native Christians are permitted to have a Roman Catholic priest and church. It is governed by an officer sent from Ava. The French formerly had a settlement here. Long. 98° 23′ E., lat. 12° 12′ N.

The MERGUI ARCHIPELAGO consists of islands extending 135 miles from north to south, along the coast of Tannaserim, and the isthmus of the Malay peninsula, with a strait between them and the mainland, of fifteen to thirty miles broad, having regular soundings and good anchorage. The islands are well wooded and edged with rocks, encrusted with small oysters. They are not inhabited, although the soil appears fertile. The principal are King's Island, St. Matthew's, Clara, and Tannaserim. They belong to the Birmans.

MERGUS, in ornithology, a genus of birds of the order of anseres, distinguished by having the beak of a cylindrical figure, hooked at the extremities, and its denticulations of a subulated form.

1. M. albellus, the smew, weighs about thirty-four ounces; the length eighteen inches, the breadth twenty-six; the bill is nearly two inches long, and of a lead color; the head is adorned with a long crest, white above and black beneath; the head, neck, and whole under part of the body, are of a pure white; the tail is of a deep ash-color; the legs a bluish-gray. The female, or lough diver, is less than the male; the back, the scapulars, and the tail, are dusky; the belly is white. The smew is seen in England only in winter, when it is sometimes met with at the southern parts of it; also in France, where it is called la piette; in Kent it is called the Magpie diver. On the continent it is found as far south as Carniola; it frequents also Iceland, where, or in some other arctic region, it passes the summer; and where it is supposed to breed, as it has been observed to migrate, in company with other mergansers, ducks, &c., in their course up the Wolga, in February. It also inhabits America.

1. M. cucullatus, or crested diver of Catesby, has a globular crest, white on each side; and the body is brown above and white below. This elegant species inhabits North America. It appears at Hudson's Bay about the end of May, and builds close to the lakes. The nest is composed of grass, lined with feathers from the breast; the number of eggs is from four to six. The young are yellow; are fit to fly in July, and all depart thence in autumn. They appear at New York, and other parts as low as Virginia and Carolina, in November, where they frequent fresh waters. They return to the north in March; and are called at Hudson's Bay Omiska sheep.

3. M. merganser, the goosander, weighs four pounds. Its length is two feet four inches; the breadth three feet four. The bill is three inches long, narrow, and finely toothed or serrated; the color of that and of the irides is red. The dun diver, or female, is less than the male: the head and upper part of the neck are ferruginous; the throat white; the feathers on the hind part are long, and form a pendant crest; the back, the coverts of the wings, and the tail, are of a deep ash color; the greater quill-feathers are black, the less white; the breast and middle of the belly are white, tinged with yellow. The goosander seems to prefer the more northern situations to those of the south, not being seen in the latter except in very severe seasons. It continues the whole year in the Orkneys; and has been shot in the Hebrides in summer. It is common on the continent of Europe and Asia, but most so towards the north. It is found also in Iceland and Greenland, and breeds there, retiring southward in winter, when it is found about the lake Baikel. It is common in America, inhabits New York in winter, and retires thence in April to Hudson's Bay.

4. M. minutus, the red-headed smew, weighs about fifteen ounces; the length one foot four inches, the breadth one foot eleven; the bill is of a lead color; the head slightly crested and of a rust color; the hind part of the neck is of a deep gray, the fore part clouded with a lighter color of the same kind; the back and tail are of a dusky ash color, the legs of a pale ash color. It is a native of Europe. Birds of this genus (Mr. Latham observes) are in general not so well flavored as those of the duck kind; yet we have often met with the last species in the London markets, and by some they are thought to be very little inferior to the wild duck; which last now and then partakes of the fishy haut gout, a flavor not disagreeable to the palates of connoisseurs.

5. M. serrator, the red-breasted merganser, weighs about two pounds; the length is one foot nine inches, the breadth two feet seven; the bill is three inches long; the lower mandible red; the upper dusky; the irides a purplish red; head and throat a fine changeable black and

green; on the former a long pendant crest of the same color; the tail short and brown; the legs orange-colored. The head and upper part of the female are of a deep rush-color, and the tail ash-colored. These birds are most common in the northern parts of Great Britain. They breed on Loch Mari, in Ross-shire, and in the Isle of Islay. The species is common in most parts of the north of Europe, on the continent, and as high as Iceland, where it is called vatus-ond; also in the Russian dominions, about the great rivers of Siberia, and the lake Baikal. They are numerous in Greenland in summer, where they breed on the shores. The eggs are like those of a wild duck, but smaller and whiter. They dive well, and are very active in the water; but the Greenlanders often kill them with darts, especially in August, being the time of moulting. They are frequent in Newfoundland, and often appear in Hudson's Bay in large flocks, but of a larger size than in Europe. They generally come in pairs in the beginning of June, as soon as the ice breaks up; make the nest soon after their arrival, chiefly on dry spots of ground in the islands, and lay from eight to thirteen white eggs, the size of those of a duck: the nests are made of withered grass, and lined with the down of the breast. The young are of a dirty brown, like young goslings. They all depart south in October to the lakes, where they may have open water.

MERIAN (Maria Sibylla), a celebrated paintress, born at Frankfort in 1647. She was the daughter of Matthias Merian, a noted engraver and geographer. As she showed a very early fondness for painting she was instructed by Abraham Mignon, from whom she learned great neatness and delicacy of color. Her genius particularly led her to paint reptiles, flowers, and insects, which she designed from nature with extraordinary exactness and truth. She even undertook a voyage to Surinam, to paint the insects and reptiles peculiar to that climate; and on her return published two volumes of engravings from her designs, which are well known to the curious. She died in 1717. Her daughter Dorothea Henrietta Graff, who painted in the same style, and had accompanied her mother to Surinam, published a third volume from the designs of Sibylla.

MERIDA, a town of Estremadura, Spain, situated on a rising ground, on the Guadiana, across which there is here a substantial bridge. This place was the Augusta Emerita of the Romans and Goths, having been peopled with soldiers of the fifth and tenth legions. It was one of the largest and most thriving towns of ancient Spain, but fell gradually to decay in the wars between the Goths and Moors, and has never recovered itself. Its antiquities, however, render it an object of interest, and comprise vestiges of superb temples, bridges, aqueducts, baths, a triumphal arch, circus, theatre, naumachia; together with the traces of two immense reservoirs at a distance from the town. Merida was the seat of a Gothic archbishop; and a council was held here in the middle of the seventh century. Besieged and taken by the Moors, in 713, it was for some time the capital of a small kingdom. The Spaniards retook it in 1230; the French in January 1811; the British under general (now lord) Hill, in June 1812. Its environs abound in corn, wine, and fruits. Population 4500. Thirty miles east of Badajoz and 108 north-west of Cordova.

MERIDA, a province of Colombia, is bounded on the north by Maracaibo, on the east by Venezuela, on the west by Santa Maria, and on the south by Santa Fé and Juan de los Llanos. Its great geographical feature is the amazing elevation of a branch from a chain of the Andes, which entirely pervades this province on its western side, rising beyond the lower period of perpetual snow, and to the height of 15,000 feet above the level of the sea.

The climate of this province is variable, on account of the vicinity of the snowy mountains, and the unequal heights of the land. The rainy season lasts from March to November, during which time the water descends in torrents; and rains are also frequent, but not so heavy, in the other months. When westerly winds prevail febrile diseases are common.

The Rio Apure, and other rivers of considerable size, rise or receive their tributary streams from the mountains of Merida, watering in their courses immense tracts of level and fertile land which extend from these mountains to the vicinity of the Orinoco. Little is known concerning the interior of this country; but it produces maize, beans, peas, potatoes, cassada, wheat of the finest quality, barley, rye, &c., as well as the tropical and European fruits, in great plenty. It also contains several plantations of sugar, cacao, and coffee. The cattle are in immense numbers.

MERIDA, the chief city of the above province, is situated in 8° 10′ N. lat., and 73° 45′ W long.; twenty-five leagues south-east of Varinas, eighty leagues south of Maracaibo, and 140 leagues south-east of Caraccas. It stands in a valley surrounded by three rivers and lofty mountains, three leagues long and three-quarters of a league in breadth. The climate is so variable that it often experiences every day the four seasons of the year.

The rains are heavy: they fall through the whole year, and with redoubled violence from the month of March to November; but at all times they leave some interval of dry weather.

None of the three rivers is navigable, on account of the rapidity of their currents, and the obstacles opposed to navigation by straits, sometimes formed by rocks and at others by mountains: its bed is so contracted as to create falls which no boat can pass. The reason for the inhabitants not having sought to overcome these difficulties is the excessive insalubrity of that part of the lake of Maracaibo into which the river Chama disembogues.

At a short distance from the capital a college and seminary for priests is established: in this seminary also the inhabitants are educated. There are also here a handsome cathedral and three convents, with several chapels.

In the college and seminary are professors of philosophy, theology, morality, the canon and the civil law. All the schools are under the im

mediate authority of a bishop, and have a rector and vice-rector. An open disposition, a sound understanding, and a love of literature, are remarked in the whites of Merida. No class disdains labor.

The inhabitants insist that neither the cold nor the heat is ever felt here to a degree that can inconvenience, and that throughout the year either silk or woollen clothes may be worn indifferently. They peculiarly dread, however, the west wind, as it never blows without leaving traces of its malignity, and the weather is very changeable.

At some distance are plantations of sugar, cacao, and coffee, the quality of which is very superior. All the environs of Merida are covered with fruits, pulse, such as maize, beans, peas of every sort, potatoes, cassada, wheat of the finest quality, barley, &c. These are consumed on the spot, and are so abundant that the poorest people have always more food than is necessary. The butcheries of Merida supply Varinas and Pedraza. Excellent meat is at a very moderate price.

They fabricate here different articles in cotton and wool, the cheapness of which makes them preferred to those of Europe. Among these fabrics are carpets of the wool of the country, one ell long by rather more than half an ell wide, ornamented with flowers, and dyed on the spot with indigenous plants, whose red, green, blue, and yellow, are as bright and as lasting as those of our most famous manufactures.

The inhabitants, amounting to 11,500 persons, are of all colors and all classes. That of the negroes is perhaps the least numerous. That of the whites has long been divided into two parties; the Serradas and Guavirias, the names of the two principal founders of the city, who vowed a hatred against each other, which their descendants have preserved with much obstinacy, and cannot be said to be even yet perfectly extinguished.

The city, at the period when the late dreadful earthquake overwhelmed the city of Caraccas, shared the same fate, and was nearly destroyed; but has since been rebuilt and become more populous.

MERID'IAN, *n. s.* Fr. *meridien, meridional;* Ital. Span. and Port. *meridiano*; Lat. *meridies*. Noon; mid-day; the line which the sun crosses at noon; hence the highest point of power or attainment; any particular place or state: as an adjective, at the point of noon, or highest point; extended from north to south: meridional, after the French, is used for southern or southerly: meridionally is, in the direction of the meridian.

I've touched the highest point of all my greatness,
And from that full *meridian* of my glory
I haste now to my setting.
Shakspeare. Henry VIII.

All offices that require heat, as kitchens, stillatories, and stoves, should be *meridional*. *Wotton.*

Sometimes towards Eden, which now in his view
Lay pleasant, his grieved look he fixes sad;
Sometimes towards heaven, and the full blazing sun,
Which now sat high in his *meridian* tower. *Milton.*

All other knowledge merely serves the concerns of this life, and is fitted to the *meridian* thereof: they are such as will be of little use to a separate soul. *Hale.*

The true *meridian* is a circle passing through the poles of the world, and the zenith or vertex of any place, exactly dividing the east from the west. *Browne's Vulgar Errours.*

In the southern coast of America and Africa, the southern point varieth toward the land, as being disposed that way by the *meridional* or proper hemisphere. *Id.*

The Jews, not willing to lie as their temple stood, do place their bed from north to south, and delight to sleep *meridionally*. *Id.*

Your full majesty at once breaks forth
In the *meridian* of your reign. *Waller.*

Compare the *meridian* line afforded by magnetical needles with one mathematically drawn, observe the variation of the needle, or its declination from the true *meridian* line. *Boyle.*

He promised in his East a glorious race,
Now sunk from his *meridian*, sets apace.
Dryden.

The sun or moon, rising or setting, our idea represents bigger than when on the *meridian*. *Watts's Logick.*

Canst thou in whirlwinds mount aloft? canst thou
In clouds and darkness wrap thy awful brow?
And, when day triumphs in *meridian* light,
Put forth thy hand, and shade the world with night?
Young.

MERIDIAN, in astronomy, a great circle, supposed to be in the heavens exactly perpendicular to the terrestrial one. See ASTRONOMY.

MERIDIAN, in geography, is a great circle passing through the poles of the earth, and some given place on its surface. It therefore divides this surface into two hemispheres, the eastern and the western. As the terrestrial meridian is the circle over which the sun is at noon, it is consequently in the plane of the celestial meridian with which the centre of the sun coincides at that time. Now as, by the earth's revolution about its axis from west to east once in twenty-four hours, every part of the equator is successively presented to the sun, all places that are situated eastward or westward of each other have their respective meridians. It is, therefore, always the same hour of the day at all places situated on the same meridian.

The first meridian of a country is that from which its geographers, navigators, and astronomers, commence their reckoning of longitude; and, the meridians having nothing in themselves to distinguish them from each other, the fixing upon any one for this purpose is quite arbitrary; hence different persons, nations, and ages, have commenced their longitudes at different points, which has introduced no small confusion into geography. But national and even scientific jealousies are too strongly prevalent for us to hope that the world will at any early period fix on a common first meridian.

Longitudes were formerly reckoned from the island of Ferro; but, as each considerable country now usually adopts the meridian of its own capital as the first, the following longitudes reckoned from the Royal Observatory at Greenwich, will facilitate the conversion of the reckoning from one country to that of another.

Places.	Longitudes.			
Amsterdam	4°	17′	30″	E
Berlin	13	22	0	
Bern	7	20	6	
Constantinople	28	55	6	
Copenhagen	12	35	15	
Dresden	13	23	1	
Ferro	17	45	50	W
Florence	11	15	45	E
Geneva	6	9	30	
Hanover	[illegible]	42	51	
Lisbon	9	8	25	W
Madrid	3	33	8	
Munich	11	35	15	E
Naples	14	15	45	
Paris	2	20	15	
Petersburgh, St.	30	18	45	
Rome	12	25	15	
Stockholm	18	3	45	
Stutgard	9	18	0	
Turin	7	40	15	
Venice	12	20	57	
Vienna	16	22	45	
Weimar	11	52	0	

MERIDIANI, in antiquity, a name given by the Romans to gladiators who entered the arena about noon, after the restiarii had finished; so called from the time when they exhibited their prowess. They were a sort of artless combatants, who fought man with man, sword in hand. Hence Seneca observes, that the combats of the morning with beasts were full of humanity, compared with those which followed.

MERIDIONAL DISTANCE, in navigation, the same with departure, or easting and westing; being the difference of longitude between the meridian, under which the ship now is, and any other meridian which she was under before.

MERIDIONAL PARTS, MILES, or MINUTES, in navigation, are the parts by which the meridians, in a Mercator's chart, increase as the parallels of latitude decrease.

MERIONETHSHIRE, a county of the principality, is called by the Welsh Meironydd, and is the only one in Wales that, with the addition of shire, still retains its ancient appellation. It was so denominated from Meirion the son of Tibiawn, and grandson of Cunedda, a noble British chieftain, who came to North Wales in the fifth century, for the purpose of assisting in rescuing it from the grasp of a set of marauding Irish, who, for the sake of plunder, had nearly overrun the country. Having succeeded in his enterprise, he obtained a large portion of territory as a boon, and gavelled out the possessions among his ten sons, and two grandsons Maelor and Meirion.

This district appears to have been known to the Romans, and was called by them Mervinia. It is a maritime county, lying on the Irish Sea, in which part of the large bay of Cardigan washes it on the west: and formerly beat against it with such violence, as to have made considerable encroachments. According to British history, a whole cantred or hundred, called Contre'r-Gwaelod, stretching west and south-west for twelve miles in length, and about five in breadth, was swallowed up and lost. On the north this county partly borders upon that of Caernarvon, it being separated from it by an immense ravine, through which the river Glass-lyn flows, and a bridge unites the two. A portion to the north also is divided by an alpine ridge, extending from beyond Rûg on the east to Llyn Elidyr on the west. Montgomeryshire lies to the east, and the river Dovey severs it from Cardigan on the south. Its length from Beddgelert near Snowdon to Bwlch y Vedwin, on the confines of Montgomeryshire, is forty-three miles; and, from Harlech to the extreme boundary of Llangollen parish, thirty-eight.

Merionethshire is extremely mountainous, and, though the mountains are not so high as those of the adjacent county of Caernarvon, yet many are very lofty; and others of a less towering height are, from their craggy nature, both picturesque and sublime. The principal mountains of this county are Cader Idris, little inferior in elevation to Snowdon; the two Arans, Penllyn, and Fowddwy; the two Arenigs; Moelwyn, and many of less consideration. Of the comparative heights of the chief among these, an account from actual admeasurement was furnished Mr. Pennant by an ingenious gentleman of Bala, which confutes the vague notion of Cadar Idris being one of the highest mountains in Britain. It states that the highest peak, called Pen y Cadar, is 950 yards higher than the green adjacent to the town of Dolgelley; Aran Fowddwy 740 yards above Llyn Tegid; and the loftiest Arenig only twenty less than the Aran. The fall from the lake of Dolgelley Green is 180 yards, consequently the actual difference in height between the Cadar and the Aran amounts to thirty yards.

The rivers of this county are, the Dee, formed by two small rivulets which rise from springs on the side of Aran Pen-llyn, and, quickly uniting their streams, enter the lake called by the Welsh Llyn-tegid, and by the English Pimble Mere. After quitting Llyn-tegid, this river flows through the beautiful vale of Eidernion, and, passing the small town of Corwen, leaves this county and enters that of Denbigh. The Maw, or Mawddach, rises about the centre of the county, and running due south, to Dolgelly, receives the tributary Eden; and after becoming a tide estuary, and changing its course to the westward, falls into the Irish Sea at Abermaw, Anglicised into Barmouth. The Dovey, or Dyfi, has its origin at the foot of the mountainous ridge through which the celebrated pass Bwlch y Groes forms a communication with the adjacent parts of Montgomeryshire; thence taking a southerly direction, by Dinas y Mawddu, it waters part of that county as far as Machynlleth, when it re-enters Merionethshire, and, becoming a wide estuary, delivers its waters to the ocean below Aberdovey. The Glaslyn and Dwy'rid conjointly flow to the sea by the Traeth-mawr and Traeth-bychan. Numerous other rivulets and streams, chiefly supplied by mountain torrents, branch off and fertilise the numerous narrow valleys through which they flow. The principal lakes are Llyn-tegid, near Bala, and Llyn-talyllyn at the foot of Cader Idris Mountain. To these may be added Llyn Elider, Llyn Telwyn echa and isa, Llyn y Cwmbychan, Llyn Arrenig, &c.

The soil of this county is various. The mountains consist principally of granite, porphyry, and other unstratified rocks; while the secondary hills are composed of primitive or mixed schistus. The valleys contain schistose clay, and more level parts of the county abound with peat-earth, forming bogs and turbaries. From such a statement, this county may be expected to rank high in an agricultural point of view. The chief attention therefore of the inhabitants is confined to breeding and the dairy. The pastures in the valleys afford sustenance to numerous herds of horned cattle; and the hills, though the grass is coarse, are nearly clothed to their summits, furnishing most extensive sheep walks; and large flocks of sheep are seen to depasture their sides, while numerous goats browse among the adjacent crags. The peat-bogs produce turf of an excellent quality which is the principal fuel of the district. Several of the mountains are private property; and the demarcation of the different demesnes is made by dry walls, carried in many instances up to the very tops. This appears to be the case in some instances where, from the nature of the surface and the sharpness of the escarpment, they seem to set all cultivation at defiance. The average of the county has been rated at 430,000 acres; out of which 286,000 may be unenclosed, and of that number about 35,000 may be called improvable wastes. All the marshes on the sea coast, from Aberyvi on the confines of Cardiganshire to Pont Aberglaslyn on that of Caernarvonshire, are of this description. Though Merioneth cannot vie with the adjacent counties, yet considerable improvements have been made by several landed proprietors within a few years past.

It has been remarked, that the original Welsh roads, generally ascending the brow of the hill, are strikingly descriptive of the national character. The method of surmounting difficulties, in this respect, appears to have been rather by a daring spirit, than the arts of circumvention. Almost every valley and dale had a road winding round its bottom, till at the extremity a mountain barrier presented itself, which was to be passed over a sudden ascent by a path like a step-ladder. A striking instance of this still remains in the abrupt passes Bwlch y Groes near Llanynowdden, and Bwlch Verddrws near Dolgelley; and the force of the remark to no district so strongly applies as to this. But it should be observed that this country is of great extent, and the mountainous parts far exceed the plain or cultivated lands. This forms a strong obstacle in the first formation or the future improvement of the roads; for the original expense must necessarily be great, and the tolls collected at the different gates comparatively small, owing to the thinness of population and the low state of agriculture. To the credit of the county, however, the magistrates have greatly exerted themselves; and spirit with perseverance has performed much. About 200 miles of new or improved roads have been formed within the county within the space of the last thirty-seven years. Among these may be noticed the fine road from Dolgelly to Barmouth, and more especially the one from Pont Aberglaslyn towards Tan y Bwlch At the former, near the celebrated salmon-leap, the great road from Caernarvon to the south entered this county; and the portion of it between the two places was extremely difficult to pass. The traveller was necessitated either to climb alpine staircases, or, what was equally unpleasant and dangerous, to seek a guide to conduct him by the circuitous route over the Traethe-mawr sands; and, as this could only be effected at ebb tides, he was often detained for a day or night. This obstruction has now been removed by forming a new road from the bridge to Tan y Bwlch. This, winding round the mountain upon various levels, and from the beauty and grandeur of the surrounding scenery, is now considered as one of the most pleasant and diversified rides in the principality. This grand link connects a chain of roads through the whole extent of Wales, from the head of Holy Cibi in the north to that of the patron St. David in the south.

Leland observes, that several parts of the county in his time had 'meat by good plenty of wood;' so that this product of the county must have failed, as well as agriculture been neglected. But the failure in this respect is more easily accounted for than the retrograde state of husbandry, an art and practice so intimately connected with the necessaries of life. Respecting the former, avarice will easily solve the difficulty. Though this might at a subsequent period have been once as naked of woods as any in Wales, yet it is certainly at present better clad. A spirit of planting has for years pervaded the breasts of the great landholders, and still continues to increase the sylvan beauty of the county.

The manufactures of this county principally consist of woollen goods, such as strong cloths, druggets, kerseymeres, flannels, stockings, gloves, wigs, &c., made of the country wool furnished by the numerous and extensive sheep walks. This county is divided into five hundreds, containing thirty-seven parishes, and five market towns. This county, as to its ecclesiastical government, is included within the diocese of Bangor, and returns one member to the imperial parliament for the shire.

MER'IT, *n. s.* & *v. a.* Fr. *merite*, *meriter*, MERITO'RIOUS, *adj.* *meritoire*, of Lat. MERITO'RIOUSLY, *adv.* *meritum*. Desert; MERITO'RIOUSNESS, *n. s.* reward; claim; right; used generally of good, but sometimes of ill desert; hence to deserve or earn: meritorious is deserving; high on the scale of worth or desert.

Instead of so great and *meritorious* a service, in bringing all the Irish to acknowledge the king for their liege, they did great hurt. *Spenser on Ireland.*

You have the captives; use them
As we shall find their *merits* and our safety
May equally determine. *Shakspeare. King Lear.*

Whatsoever jewels I have *merited*, I am sure I have received none, unless experience be a jewel, that I have purchased at an infinite rate.
Id. Merry Wives of Windsor.

The war that hath such a foundation will not only be reputed just, but holy and *meritorious*.
Raleigh's Essays.

He carried himself *meritoriously* in foreign employments in time of the interdict, which held up his credit among the patriots. *Wotton.*

We can never fully enough comprehend in our thoughts the joys of heaven, the *meritorious* sufferings of Christ, the terrors of the second death; therefore we must meditate of them often. *Bp. Hall.*

Sufficient means of redemption and salvation, by the satisfactory and *meritorious* death and obedience of the incarnate Son of God, Jesus Christ, God blessed for ever. *Sanderson.*

Amply have *merited* of me, of all
The' infernal empire.
Milton's Paradise Lost.

She deemed I well deserved to die,
And made a *merit* of her cruelty. *Dryden.*

A man at best is incapable of *meriting* any thing from God. *South's Sermons.*

There was a full persuasion of the high *meritoriousness* of what they did; but then there was no law of God to ground it upon, and consequently it was not conscience. *South.*

This is not only the most prudent, but the most *meritorious* charity, which we can practise. *Addison.*

Those laurel groves, the *merits* of thy youth,
Which thou from Mahomet didst greatly gain,
While bold assertor of resistless truth,
Thy sword did godlike liberty maintain. *Prior.*

Roscommon, not more learned than good,
With manners generous as his noble blood;
To him the wit of Greece and Rome was known,
And every author's *merit* but his own. *Id.*

She valued nothing less
Than titles, figure, shape, and dress.
That *merit* should be chiefly placed
In judgment, knowledge, wit, and taste.
Swift.

When a point hath been well examined, and our own judgment settled, after a large survey of the *merits* of the cause, it would be a weakness to continue fluttering. *Watts.*

What numbers live to the age of fifty or sixty years! yet, if estimated by their *merit*, are not worth the price of a chick the moment it is hatched. *Shenstone.*

Real friendship is a slow grower; and never thrives, unless engrafted upon a stock of known and reciprocal *merit*. *Chesterfield.*

Then, conscious of her *meritorious* zeal,
To justice she may make her bold appeal.
Cowper.

MER'LIN, *n. s.* Barb. Lat. *merillus*; Belg. *smerlin*. A kind of hawk.

Not yielding over to old age his country delights, he was at that time following a *merlin*. *Sidney.*

MERLIN (Ambrose), a famous English poet and reputed prophet, who flourished about A. D. 480. Many surprising and ridiculous things are related of him. Several English authors have represented him as the son of an incubus, and as transporting from Ireland to England the great stones which form Stonehenge. Extravagant prophecies and other works are also attributed to him, on which some authors have written commentaries.

MER'MAID, *n. s.* Goth. *mar*, the sea, and maid. A sea woman; an animal, real or supposed, with a woman's head and fish's tail.

Thou remembrest,
Since once I sat upon a promontory,
And heard a *mermaid* on a dolphin's back
Uttering such dulcet and harmonious breath,
That the rude sea grew civil at her song.
Shakspeare.

Did sense persuade Ulysses not to hear
The *mermaids'* songs, which so his men did please,
That they were all persuaded, through the ear,
To quit the ship and leap into the seas? *Davies*

Few eyes have escaped the picture of a *mermaid* Horace's monster, with woman's head above, and fishy extremity below, answers the shape of the ancient syrens that attempted upon Ulysses.
Browne's Vulgar Errours.

MERODACH, an ancient king of Babylon, who was placed among the gods, and worshipped by the Babylonians. See Jerem. l. 2. We find several kings of Babylon of whose names Merodach makes a part, as Evilmerodach and Merodach-Baladan. See EVILMERODACH and BALADAN.

MERODACH-BALADAN, son of Baladan king of Babylon, is called by Ptolemy Mardocempadus. He says that he began to reign a Babylon twenty-six years after the beginning of the era of Nabonassar, A. M. 2283.

MEROE, in ancient geography, an island of Ethiopia, beyond Egypt, in the Nile, with a cognominal town, the metropolis of the Ethiopians. The Jesuits have endeavoured to prove that the province of Gojam in Abyssinia is the Meröe of the ancients; but Bruce has proved, almost beyond a doubt, that the peninsula of Athara formerly bore that name. Diodorus Siculus says that Meröe had its name from a sister of Cambyses king of Persia, who died there in the expedition undertaken by that prince against the Ethiopians. His army perished with hunger and thirst in the deserts beyond Meröe; which could not have happened if they had reached Gojam, the latter being one of the most plentiful countries in the world. A further proof that Gojam cannot be the ancient Meröe is, that the latter was enclosed between the Nile and Astaboras, while Gojam is almost entirely surrounded by the Nile. If the ancients were acquainted with Gojam, they must also have been acquainted with the fountains of the Nile, which we know they were not. Pliny says that Meröe, the most considerable of all the islands of the Nile, was called Astaboras, from the name of its left channel, which cannot be supposed any other than the junction of the Nile and Atbara. Again, the poet Lucan describes Meröe by two circumstances which cannot apply to any other than the peninsula of Atbara. One is, that the inhabitants were black, which was the case with the Gymnosophists and first inhabitants, and which has been the case with all the rest down to the Saracen conquest; but the inhabitants of Gojam, as well as the other Abyssinians, are fair, at least greatly different in complexion from the blacks; they are also long haired. The other is, that the ebony tree grew in the island of Meröe, which still grows plentifully in the peninsula of Atbara, but not in Gojam, where it could not subsist on account of the violent rains during six months of the year.

MEROM, or MEROME, in ancient geography, the waters of Merom, the place at which Jabin and the other confederate kings met to fight Joshua (xi. 5), generally supposed to be the lake Semechon, which lies between the head of the Jordan and the lake Gennesareth; as it is gene-

rally agreed that Hazor, where Jabin reigned, was situated upon this lake. Others think, with considerable probability, that the waters of Merom were somewhere about the brook Kishon, a place of that name being mentioned in Judges v. 21, where the account of the battle is recorded.

MEROPE, in fabulous history, one of the Atlantides. She married Sisyphus the son of Æolus, and like her sisters was changed into a star, in the constellation Pleiades, after death. It is said that in this constellation the star of Merope appears more dim and obscure than the rest, because she married a mortal, while her sisters married some of the gods or their descendants.

MEROPS, in fabulous history, a king of the island of Cos, who married Clymene, one of the Oceanides. He was changed into an eagle, and placed among the constellations.

MEROPS, a celebrated soothsayer of Percosus in Troas, who foretold the death of his sons Adrastus and Amphius, who were engaged in the Trojan war. They slighted their father's advice, and were killed by Diomedes.

MEROPS, in ornithology, a genus belonging to the order of picæ. The bill is crooked, flat, and carinated; the tongue is jagged at the point; and the feet are of the walking kind. There are twenty or thirty species.

1. M. apiaster, the bee-eater, has an iron-colored back; the belly and tail are of a bluish-green; and the throat is yellow. This species inhabits various parts of Europe, on the continent, though not in England; yet has been seen in Sweden. They are now and then seen in Lorraine, though only in pairs; and are frequent in other parts. Kramer talks of their building nests in the sandy crags of the Danube. They are met with in Italy and the south of France; and in Candia and other islands of the Mediterranean they are numerous, as well as in Palestine and Arabia, being very common in the woods about Yemen, where they are called schæghagha. It takes the name of bee-eater from its being very fond of those insects: it will also catch gnats, flies, cicadæ, and other insects, on the wing, like the swallow. Willoughby tells us, from Belon, 'that its singular elegancy invites the Candian boys to hunt for it with cicadæ, as they do for swifts, in this manner:—Bending a pin like a hook, and tying it by the head to the end of a thread, they thrust it through the cicada (as boys bait a hook with a fly), holding the other end of the thread in their hands: the cicada, so fastened, flies nevertheless in the air; which the Merops spying, flies after it with all her force; and, catching it, swallows pin and all, wherewith she is caught.' This species is said to be most plentiful in the isle of Candia; and, in defect of insects, to eat seeds of many kinds; and Ray supposes, from its similarity to the kingfisher, it may possibly feed on fish. Willoughby saw many of them exposed for sale in the markets of Rome. These birds make their nests in deep holes on the banks of rivers, like the kingfisher, at the end of which the female lays from five to seven white eggs, rather smaller than those of a blackbird. The nest itself is composed of moss.

2. M. erythropterus, the red-winged bee-eater, is in length six inches; the bill is one inch, and black; the upper parts of the head, body, wings, and tail-coverts, are green brown, deepest on the head and back, lightest on the rump and tail-coverts; behind the eye is a spot of the same, but of a very deep color; the quills and tail are red, tipped with black; the last two inches in length; the throat is yellow, the under parts of the body are a dirty white; and the legs black. This species inhabits Senegal, from which place a well preserved skin was brought by M. Adanson.

3. M. Novæ Hollandiæ, the wattled bee-eater, is the size of a cuckoo, in length about fourteen inches and a half. The feathers on the upper part of the head, being longer than the rest, give the appearance of a crest; those of the under part are smooth; the plumage for the most part is brown; the feathers are long and pointed, and each feather has a streak of white down the middle; under the eye, on each side, is a kind of wattle, of an orange color; the middle of the belly is yellow; the tail is wedge-shaped, similar to that of the magpie, and the feathers are tipped with white; the bill and legs are brown. This species is said to be peculiar to New Holland.

4. M. superciliosus is green, with a white line both above and below the eyes, and a yellow throat. It is found in Madagascar, where the natives call it patirich-tirich.

MEROVINGIAN CHARACTER, an ancient character much used under the Merovingian race of French kings. There are many MSS. in the French libraries, still extant in this character.

MEROVINGIAN RACE, the most ancient race of the French kings, so named from Meroveus, the third king of France of that race, which reigned 333 years, from Pharamond to Charles Martel. This race terminated in Childeric III. A. D. 751. See FRANCE.

MERRIMACK, a river of North America, which rises in New Hampshire. The most northern branch, the Pemigewasset, rises from the White Mountains and Moosehillock, and, after a southerly course of about seventy miles, is joined by the Winnipiseogee at Sanborntown, and then takes the name of Merrimack. The course continues southerly about eighty miles, as the river runs, when it reaches Massachusetts line. It then turns to the east, and, after a course of about fifty miles, falls into the Atlantic below Newburyport. It is navigable for vessels of 200 tons to Haverhill. By means of this river, and the Middlesex Canal, an extensive boat navigation is opened between Boston and the state of New Hampshire, as far as Concord. The principal falls on the Merrimack, around which canals are constructed, are Isle of Hookset, Amoskeag, and Patucket.

MER'RY, *adj.*
MER'RILY, *adv.*
MER'RY-MAKE, *n. s.* & *v. n.*
MER'RIMENT, *n. s.*
MER'RINESS,
MER'RY-ANDREW,
MER'RY-THOUGHT,

Probably Sax. mepnian, gladness. Teut. *mere*, *meyr*, has a similar signification. Gay; jovial; loudly cheerful; causing laugh-

ter; prosperous. To make merry' is to be jovial, or extremely cheerful: a merry-make is a festival; meeting for mirth; mirthful pranks: to merry-make, to feast; be jovial: merriness and merriment mean gaiety; laughing, or loud mirth; gay disposition: a merry-andrew is a buffoon, or harlequin: merry-thought, a forked bone on the body of fowls, so called because young people pull in play at the two sides, the longest part broken off betokening priority of marriage.

They drank and were *merry* with him.
Gen. xliii. 34.

They trod the grapes and *made merry*, and went into the house of their God. *Judg.* ix. 27.

Thenot now nis the time of *merrymake*,
Nor Pan to herie, nor with love to play,
Sike mirth in May is meetest for to make,
Or Summer shade, under the cocked hay.
Spenser.

The knight did not forbear,
Her honest mirth and pleasure to partake;
But when he saw her gibe, and toy, and geare,
And pass the bounds of modest *merrimake*,
Her dalliance he despised. *Faerie Queene.*

Who, when they heard that piteous strained voice,
In haste forsook their rural *merryment*. *Id.*

A number of *merriments* and jests, wherewith they have pleasantly moved much laughter at our manner of serving God. *Hooker.*

You killed her husband, and for that vile fault
Two of her brothers were condemned to death;
My hand cut off, and made a *merry* jest.
Shakspeare.

Merrily, merrily, shall we live now,
Under the blossom that hangs on the bough. *Id.*

The stile shall give us cause to climb in the *merriness*. *Id.*

Some, that are of an ill and melancholy nature, incline the company into which they come to be sad and ill-disposed; and others, that are of a jovial nature, do dispose the company to be *merry* and cheerful.
Bacon's Natural History.

Methought it was the sound
Of riot and ill-managed *merryment*. *Milton.*

A paisan of France thinks of no more than his coarse bread and his onions, his canvass clothes and wooden shoes, labours contentedly on working days, and dances or plays *merrily* on holidays.
Temple's Miscellanies.

In my small pinnace I can sail,
Contemning all the blustering roar;
And, running with a *merry* gale,
With friendly stars my safety seek
Within some little winding creek,
And see the storm ashore. *Dryden.*

A fox 'spied a bevy of jolly, gossipping wenches, *making merry* over a dish of pullets. *L'Estrange.*

He would be a statesman because he is a buffoon; as if there went no more to the making of a counsellor than the faculties of a *merry-andrew* or tumbler.
Id.

The *merry* part of the world are very amiable, while they diffuse a cheerfulness through the conversation, at proper seasons, and on proper occasions.
Addison.

Man is the *merriest* species of the creation; all above and below him are serious. *Id.*

With thee 'twas Marian's dear delight
To moil all day, and *merrimake* at night. *Gay.*

Let him not be breaking *merrythoughts* under the table with my cousin. *Echard.*

Merrily sing, and sport, and play,
For 'tis Oriana's nuptial day. *Granville.*

MERRY (Robert), an English poet educated under the celebrated Dr. Barr at Harrow, and afterwards at Christ Church Oxford. He purchased a commission in the guards, and published several esteemed pieces, under the title of Della Crusca; and his tragedy of Lorenzo was acted at Covent Garden. He married Miss Brunton, an actress, with whom he went to America, where he died in 1798.

MERRYMEETING BAY, a bay of Maine, United States, formed by the junction of the rivers Androscoggin and Kennebeck, on the west side of Woolwich, and north of Bath, eighteen miles from the sea.

MERS EL KEBEER, or MAZALQUIVER, a seaport of Algiers, anciently called, from its great extent, Portus Magnus, was taken by the Spaniards in 1705, lost by them in 1708, but recovered in 1732. It is defended by a large but weak fort. Six miles west of Oran.

MERSA, a town of Barbary, pleasantly situated about eleven miles from Tunis, and two from Melcha, the site of ancient Carthage. The bey has two country houses, one of them very costly work, built by Hassan Bey. From these are orange gardens reaching almost to the shore; on the edge of which is a famous well of sweet water, esteemed the best in the kingdom. Close to this is a coffee-house, whither numbers of people from the neighbouring places resort to drink coffee, and a glass of this natural luxury so peculiarly enjoyed in the eastern countries. In the middle of the court is a large mulberry tree, under the shade of which they sit, smoke, and play at chess, inhaling the comfortable sea breeze that refreshes this delightful spot. The water is drawn up by a camel with the Persian wheel. Here are the remains of an ancient port (supposed to be artificial) built by the Carthaginians, after Scipio had blocked up the old port, nothing but the turret, or light-house, being left.

MERSEBURG, one of the new governments of Prussia, containing that part of Saxony which lies to the south of Anhalt, and to the east of Erfurt; and comprises the chief part of the old electoral circle of Saxony; a small part of Thuringia; the bishoprics and chapter lands of Merseburg, Naumburg, and Zeitz; part of the duchy of Magdeburg; part of the districts of Leipsic and Meissen; with the counties of Mansfeld and Stolberg. The river Unstrut forms part of its western boundary. It consists almost entirely of cessions made by Saxony in 1815; the united territories composing a total of 4000 square miles, with 471,000 inhabitants, divided into seventeen districts or circles.

MERSENNE, or MERSENNUS (Marin), a learned French author, born at Oyse, in the province of Maine, in 1588. He studied at La Fleche with Des Cartes, with whom he contracted a friendship which lasted till death. He afterwards went to Paris, and studied at the Sorbonne; and in 1611 entered among the Minims. He became well skilled in Hebrew, philosophy, and mathematics. He was of a tranquil, sincere, and engaging temper; and was universally esteemed. He taught philosophy and divinity in the convent of Nevers, and at length became superior of it; but, wishing to

study with more freedom, he resigned all the posts in his order, and travelled into Germany, Italy, and the Netherlands. He wrote a great number of excellent works, the principal of which are, 1. Questiones Celeberrimæ in Genesim. 2. Harmonicorum Libri. 3. De Sonorum Naturâ, Causis, et Effectibus. 4. Cogitata Physico-mathematica. 5. La Verité des Sciences. 6. Les Questions Inouies. He died in Paris in 1648.

MERSEY, a river of England, that runs through the counties of Lancaster, York, and Chester, and falls into the Irish Sea at Liverpool. It receives numerous accessions in its course, of which the principal are the Irwell from Manchester, and the Weaver from Cheshire, and spreads out into a wide but shallow channel. It is navigable up to the Irwell, and affords salmon, and shoals of smelts called sparlings, of remarkable size and flavor.

MERSEY ISLAND, an island of Essex, at the mouth of the Coln, south of Colchester. It was seized by the Danes in the reign of king Alfred, for their winter quarters. It had eight parishes, now reduced to two, viz. east and west Mersey. It had a block-house; and during the Dutch war, the parliament put 1000 men in it.

MER'SION, *n. s.* Lat. *mersio.* The act of sinking, or thrusting over head.—*Ainsworth.*

MERTHYR TYDVILL, a market town of Glamorganshire, situated in the midst of an extensive mining district, and at the distance of about 180 miles west from London, and twenty-four N. N. W. from Cardiff. It was formerly but a small village, and though now the principal trading town of Wales is meanly and irregularly built, having no connected streets. It owes its prosperity entirely to the mines in its vicinity, which consist principally of coal and iron. The agricultural improvements of the neighbourhood may be traced to the same origin, the vast quantities of manure produced by the horses, &c., employed in the mines, enabling the farmer to raise his land to the highest pitch of cultivation. It is supposed that there are forged weekly within ten miles of this town upwards of 1000 tons of iron. There are also several lead mines supposed to have been worked as far back as the times of the Romans. This town has a new church, a theatre, several dissenters' chapels, and two reading societies; and a fine canal has been cut from this place to Cardiff. On the top of a mountain, three miles distant, north, are the ruins of Merlais Castle, said to have been the residence of the kings of Brecknock. This town sends one member to parliament.

MERULA (George), an Italian of extraordinary parts and learning, born at Alexandria about 1420. He taught youths at Venice and Milan for forty years, and labored much in restoring and correcting ancient authors. He wrote, and addressed to Louis Sforza, Antiquitates Vicecomitum, &c., or the Actions of the Dukes of Milan, in ten books, with some other pieces. He died in 1494, unlamented, as he had abused almost all his contemporary scholars.

MERULA (Paul), born at Dort in Holland, a famous lawyer, historian, and linguist, was professor of history in the university of Leyden after Lipsius. He wrote, 1. Commentaries on Ennius; 2. The Life of Erasmus and Junius; 3. A Cosmography; 4. A Treatise of Law; and died in 1607.

MERULA, in ornithology. See TURDUS.

MERUS, in ancient geography, a mountain of the Hither India, hanging over the city Nyssa, built by Bacchus, and situated between the rivers Cophen and Indus. The name, denoting the thigh, gave rise to the fable of Bacchus being sewed up into Jupiter's thigh, and being born twice; because in this mountain he and his army are said to have been preserved, when disease and pestilence raged in the plains below.

MERU SHAH JEHAN, the ancient Antiochia, a city of Korassan, in Persia, capital of Margana, on the river Murghab. It was one of the four imperial cities of this country, and the capital of many of the Persian sultans of the Seljukian dynasty. It was then surrounded by the beautiful gardens, the fruits of which were accounted most exquisite. Alp Arslan, the most powerful prince of his time, reigned here for a number of years. About twenty years ago this capital was taken and pillaged by the Uzbecks, since which time it has gradually declined. The population is not at this time above 3000. It is 130 miles north-east of Mesched.

MERSEBURG, an old town of Prussian Saxony, the capital of a government of the same name, stands fifteen miles west of Leipsic, on the Saale, and has narrow crooked streets; but they are clean and well paved. The cathedral, which has a fine organ, the gymnasium, and the palace of the bishops and dukes, are worth notice. Brewing is largely carried on here. Population 6800.

MESCHED, a city of Korassan, the capital of the Persian port of that province, is chiefly distinguished by a noble mausoleum, containing the remains of Imam Reza and the celebrated Caliph Haroun Al Raschid. It is called a 'holy city,' and surrounded with a wall seven miles in circuit. There is also an inferior palace here called 'the ark,' and a bazaar three miles in length, which is well supplied with fruits and vegetables. The houses are in general mean, but the inhabitants are said to amount to 50,000. Beautiful velvet pelisses and fur are manufactured here, and a considerable trade is carried on with Bukhara, Kandahar, Herat, and Yeza. It is about five miles from the ancient Tous, in long. 57° E., and lat. 37° 35′ N.

MESCHED ALI, or NEJETT, a town of Irak Arabi, containing the burial place of the caliph Ali, a noble structure, encircled by a high wall, within which it is death for an infidel to be found. The dome is light and elegant, and, together with the tops of the minarets, was gilded at the expense of Nadir Shah. The town is entirely supported by the influx of Persian pilgrims and devotees. The environs are barren, and rendered gloomy by the number of graves which cover them; persons of consequence being brough here for interment from the most remote parts of Persia. Ninety miles south of Bagdad.

MESCHIE, or MENSHEEL, a town of Upper

Egypt. The ancient Ptolemais, immediately opposite to Achmim. It enjoys a considerable trade, as the vessels between Cairo and the cataracts usually stop here for provisions. There are very fine pigeon-houses in the neighbourhood.

MESEEMS', *impers. v.* Me and seems, or it seems to me. For this word, says Dr. Johnson, it is now too common to use methinks or methought, an ungrammatical word. I think; it appears to me; methinks.

Alas! of ghosts I hear the ghastly cries;
Yet there, *meseems*, I hear her singing loud.
Sidney.

Meseemed by my side a royal maid,
Her dainty limbs full softly down did lay.
Faerie Queene.

To that general subjection of the land *meseems* that the custom or tenure can be no bar nor impeachment. *Spenser.*

MESEMBRYANTHEMUM, fig marigold, in botany, a genus of the pentagynia order and icosandria class of plants; natural order thirteenth, succulentæ: CAL. quinquefid; the petals are numerous and linear: CAPS. fleshy, inferior, and monospermous. There are between forty and fifty species, all African plants, from the Cape of Good Hope; nearly forty of which are retained in gardens for variety. Of these only one, viz.

M. crystallinum, the diamond ficoides or ice plant, is annual, and the most remarkable of them all. It rises with a short, thick, succulent stalk, dividing low into many trailing, very spreading, succulent branches, bespangled all over with icy pimples; very pellucid and glittering; oval, undulate, alternate, papulose or pimply, glittering leaves; and from the sides of the branches, numerous, almost close sitting, white flowers, tinged with red or crimson; succeeded by plenty of seed in autumn. This singular and curious plant, being closely covered with large pellucid pimples, full of moisture, shining brilliantly, is in great esteem. It is a very tender plant while young; and is raised annually from seed in hot-beds. In June it will endure the open air till October, when it perishes; but if placed in a hot-house in autumn, it will often live all winter. It is commonly planted in pots for the conveniency of removing; but if planted in full ground, it grows considerably stronger, even to luxuriance: however, when confined in pots, it flowers more abundantly. The other species are most durable in stem and foliage. Some are shrubby; others pendulous, with loose straggling stems, and branches inclining to the ground; while others have no stalks at all: their leaves are universally very thick, succulent, fleshy, and of many various shapes, situations, and directions; while some are curiously punctured, or dotted with transparent points, and some have pellucid pimples, as already mentioned: they afford a very agreeable variety at all times in the year, and merit a place in every collection. They are green-house plants, and are propagated by cuttings of their stalks and branches.

MESEN, a town of European Russia, on the Mesen, in the government of Archangel. It is the chief town of a circle, which includes the region of Nova Zembla. Its chief trade is in fish, whale-oil, and sea-dogs. Population 2000. 138 miles E. N. E. of Archangel, and thirty from the mouth of the river.

MESEN, a large river of European Russia, rising in the government of Archangel: after numerous windings it takes a N. N. W. direction, and falls into the White Sea.

MESENGUY (Francis Philip), a French divine, born at Beuvais in 1677. He wrote, 1. Exposition de la Doctrine Chretienne, 6 vols. 12mo., which was condemned by Pope Clement XIII. 2. Abregé de l'Histoire et de la Morale de l'Ancien Testament, 12mo. 3. Abregé de l'Histoire de l'Ancien Testament, 10 vols. 12mo. 4. Some tracts on the bull Unigenitus. He died in 1769.

MESENTERY, MESENTERIUM, is so called from μεσος, middle, and εντερον, intestine, as being placed in the middle of the intestines, which it connects to one another. See ANATOMY, Index.

MES'ERAICK, *n. s.*, MESEN'TERY, *n. s.*, MESENTER'IC, *adj.* } Fr. *meseraique, mesentere, mesenterique;* Gr. μεσαραιον. Belonging to the mesentery; this is also the meaning of mesenteric: the mesentery, a part of the PERITONEUM, which see.

It taketh leave of the permanent parts at the mouths of the *meseraicks*, and accompanieth the inconvertible portion into the siege. *Browne.*

The most subtile part of the chyle passeth immediately into the blood by the absorbent vessels of the guts, which discharge themselves into the *meseraick* veins. *Arbuthnot.*

When the chyle passeth through the *mesentery*, it is mixed with the lymph. *Arbuthnot on Aliments.*

They are carried into the glands of the *mesentery*, receiving a fine lymph from the lymphatick ducts, which dilutes this chylous fluid, and scours its containing vessels, which, from the *mesenterick* glands, unite in large channels, and pass directly into the common receptacle of the chyle. *Cheyne.*

MESERITZ, or MIENDZYRZECZ, a town of Prussian Poland, on the borders of Silesia, in a fruitful district, between the Obra and the Packlitz. Population 3600. Fifty-five miles west of Posen.

MESH, *n. s.* & *v. a.*, MESH'Y, *adj.* } Old Fr. *mache.* See MASH. The interstice of a net: to ensnare or catch in a net: meshy is reticulated; worked as a net.

Such a hare is madness the youth, to skip o'er the *meshes* of good counsel the cripple. *Shakspeare.*

The flies by chance *mesht* in her hair,
By the bright radiance thrown
From her clear eyes, rich jewels were,
They so like diamonds shone. *Drayton.*

The drovers hang square nets athwart the tide, thorough which the shoal of pilchard passing, leave many behind entangled in the *meashes.* *Carew.*

Some build his house, but thence his issue barre,
Some make his *meshy* bed, but reave his rest. *Id*

He spreads his subtle nets from sight,
With twinkling glasses to betray
The larks that in the *meshes* light. *Dryden.*

With all their mouths the nerves the spirits drink,
Which through the cells of the fine strainers sink:
These all the channel'd fibres every way,
For motion and sensation, still convey:
The greatest portion of the' arterial blood,
By the close structure of the parts withstood,
Whose narrow *meshes* stop the grosser flood.
Blackmore.

Caught in the *meshy* snare, in vain they beat
Their idle wings. *Thomson.*

MES'LIN, *n. s.* Fr. *mesler*, to mix; or corruptly pronounced for *mescellane*. See MASLIN. Mixed corn.

If worke for the thresher ye mind for to have,
Of wheat and of *mestlin* unthreshed go save.
Tusser.

What reason is there which should but induce, and therefore much less enforce, us to think, that care of old dissimilitude between the people of God and the heathen nations about them, was any more the cause of forbidding them to put on garments of sundry stuff, than of charging them withal not to sow their fields with *meslin*? *Hooker.*

MESNARDIERE (Hippolytus Julius Pilet de la), a French poet, born in 1610. He was partronised by cardinal Richelieu, and was a member of the French Academy. He published, 1. A Treatise on Melancholy. 2. Alinde; and 3. The Maid of Orleans, tragedies; 4. Poetique; and 5. A Collection of Poems. He died in 1663.

MESNE, or MESN, a term in law, signifying him who is lord of a manor, and so hath tenants holding of him; yet he himself holds of a superior lord. The word is derived from maisne, quasi minor natu; because his tenure is derived from another, of whom he holds.

MESNE, a writ, which lieth where there is lord mesne and tenant; and the tenant is distrained for services due from the mesne to the superior lord. This is in the nature of a writ of right; and in this case the tenant shall have judgment to be acquitted or indemnified by the mesne lord; and if he make default therein, or do not appear originally to the tenant's writ, he shall be forejudged of his mesnalty, and the tenant shall hold immediately of the lord paramount himself.

MESOCHRI, musicians among the ancients, who presided in concerts, and, by beating a wooden desk regularly with their feet, directed the measure of the music. For the purpose of beating time, they wore wooden clogs, called by the ancients crupezia, which occasioned the sound to be better heard.

MESOCOLON, in anatomy, that part of the mesentery, which, having reached the extremity of the ilium, contracts, and changes its name. See ANATOMY.

MESO-LOGARITHMS, *n. s.* A term used by Kepler for the logarithms of cosines and tangents. See LOGARITHMS.

MESOPORPHYRON, a name given by the Greeks to the Roman laticlave; because that garment, being edged on each side, where it opened before, with purple, appeared when closed with two purple stripes down the middle. The same term was also applied to the angusticlave.

MESOPOTAMIA, the ancient name of the province of Diarbeck, in Asiatic Turkey. It is situated between the Euphrates and Tigris; having Assyria on the east, Arabia Deserta with Babylonia on the south, Syria on the west, and Armenia on the north. The Hebrews called it Padan-aram (Gen. xxviii. 2, &c.), and Aram Naharaim (Psalm lx.) or Aram of the two rivers, because it was first peopled by Aram the ancestor of the Syrians, and is situated between the two rivers above mentioned. This country is much celebrated in Scripture, as being the first dwelling of men both before and after the deluge; and because it gave birth to Peleg, Heber, Terah, Abraham, Nahor, Sarah, Rebekah, Rachel, Leah, and the sons of Jacob. Babylon was in the ancient Mesopotamia, and, by vast labor and industry, the two rivers of the Tigris and Euphrates were united into one channel. The plains of Shinar were in the same country. Often they gave it the name of Mesopotamia (Deut. xxiii. 4, &c.), and sometimes that of Syria (Hosea xii. 12). Balaam son of Beor was of Mesopotamia (Deut. xxiii. 4). Chushan-rishathaim king of Mesopotamia kept the Hebrews in subjection some time after the death of Joshua, Judg. iii. 8.

MESPILUS, the medlar, in botany, a genus of the pentagynia order, and icosandria class of plants; natural order thirty-sixth, pomaceæ: CAL. quinquefid; the petals are five; the berry is inferior and pentaspermous.

1. M. amelanchier, the shrubby medlar, with black fruit, rises with several shrubby, slender, hairy stems, branching moderately about four feet high, having purplish branches; oval serrated leaves, downy underneath; and small white flowers in clusters at the ends of the branches; succeeded by small black fruit.

2. M. arbutifolia, arbutus-leaved mespilus, has a shrubby stem, branching five or six feet high; lanceolate, crenated, alternate leaves, downy underneath; and from the sides and ends of the branches small white flowers in clusters; succeeded by small, roundish, purple fruit, like haws.

3. M. Canadensis, Canada snowy mespilus, has a shrubby, smooth stem, branching four or five feet high, with smooth, purplish branches; oval oblong, serrated, smooth leaves, on long foot-stalks; and all the branches terminated by snowy white clusters of flowers, succeeded by small purplish fruit like haws.

4. M. chamæ-mespilus, the dwarf medlar, or bastard quince, has a shrubby, slender, smooth stem, branching weakly four or five feet high, having purplish branches; oval, serrated, smooth leaves on long foot-stalks; and from the axillas purple flowers, collected into round heads, with narrow, purplish, deciduous, bracteæ; succeeded by small red fruit.

5. M. cotoneaster, the dwarf quince, rises with a shrubby, smooth stem, branching four or five feet high; the branches slender and reddish; oval entire leaves, on short foot-stalks; and from the axillas, small close-sitting purple flowers, two or three together; succeeded by small, roundish, bright red fruit.

6. M. Germanica, German mespilus, or common medlar, rises with a deformed tree stem, branching irregularly fifteen or twenty feet high; spear-shaped leaves, downy underneath; and large, close-sitting, white flowers, singly from the sides of the branches; succeeded by large roundish brown fruit, the size of middling apples, which ripen in October, but are not eatable till beginning to decay. The varieties are, common great German medlar, smaller Nottingham medlar, and spear-shaped Italian medlar. These all all cul

tivated in the English gardens for the fruit: the two former are the most common; but the latter, though smaller, is preferable for richness of flavor. These kinds are never eatable, until they begin to rot; for, when firm and sound, they are of a singularly austere disagreeable taste; yet having lain some time after being gathered, till they begin to assume a state of decay and become soft, they acquire a delicious flavor, extremely agreeable to many. They all ripen in the end of October, or beginning of November; when, being gathered, some should be laid in moist bran, in several layers, to forward their decay; others on straw in the fruitery; those in the bran will be ready for use in about a fortnight, and those laid on straw will come forward in succession.

7. M. pyracantha, the evergreen thorn, rises with a shrubby spinous stem, branching diffusely twelve or fourteen feet high, the branches slender and flexible, with a dark greenish bark, armed with long sharp spines; spear-shaped, oval, crenated, evergreen leaves; and all the shoots terminated by numerous clusters of whitish flowers; succeeded by large bunches of beautiful red berries, remaining all winter, and exhibiting a very ornamental appearance. All these seven species are of the tree and shrub kind; the first six are deciduous, the seventh an evergreen; the leaves are universally simple; those of the mespilus Germanica very large, the others mostly of moderate size, and which in most of the sorts grow upon short foot-stalks. They all flower abundantly every summer, the flowers universally hermaphrodite, and consisting each of five large roundish petals, twenty stamina, and five styles. They are all very hardy, succeed in any soil and situation, and their propagation and culture are very easy. The Germanica and its varieties are cultivated as fruit-trees, chiefly as standards, sometimes also as espaliers for variety. The other species are very proper furniture for any ornamental plantation, where they make an agreeable variety with their different foliage; and their flowers make a fine appearance, as also their fruit in autumn and winter, which, if not devoured by birds, remain long on the branches, and afford a fine variety in those seasons. The pyracantha, being rather of flexible growth, is most commonly trained against walls or fronts of houses, for the support of its flexible branches. When it is designed to have any of the common medlars as fruit-trees, they may be trained either as dwarfs, for dwarf standards, or for espaliers, or as half or full standards, and managed nearly as other fruit trees, particularly the apple and pear. They are raised either by seed, by grafting, or by budding; but the two latter methods are the most certain for continuing the sorts without variation.

MESPRISE'. Of Fr. *mesprise, mespris.* Contempt; scorn. Obsolete.

Mammon was much displeased, yet not he chose
But bear the rigour of his bold *mespise*,
And thence him forward led, him further to entice.
Spenser.

MESS, *n. s.* & *v. a.* } Saxon meꞅe; Goth.
MESS'MATE, *n. s.* } *mesa*; Fr. *messe*; Ital. *messo.* A dish; quantity of food eaten at table; the party or society meeting there: to mess is to eat or partake the food: messmate, a mate at mess or table.

The bounteous huswife Nature, on each bush
Lays her full *mess* before you.
Shakspeare. Timon of Athens.

Now your traveller,
He and his toothpick at my worship's *mess.*
Shakspeare.

Had either of the crimes been cooked to their palates they might have changed *messes.*
Decay of Piety.

Herbs and other country *messes*,
Which the neat-handed Phillis dresses.
Milton.

From him he next receives it thick or thin,
As pure a *mess* almost as it came in. *Pope.*

MES'SAGE, *n. s.* } Fr. *message, messager*;
MES'SENGER. } of Lat. *missus.* An errand; advice or intelligence sent: messenger one who carries a message or tidings.

She doth display
The gate with pearls and rubies richly dight,
Through which her words so wise do make their way,
To bear the *message* of her gentle spright. *Spenser.*

Came running in, much like a man dismaid,
A *messenger* with letters, which his *message* said.
Id.

May one, that is a herald, and a prince,
Do a fair *message* to his kingly ears?
Shakspeare.

She is fair, and fairer than that word,
Of wondrous virtues; sometimes from her eyes
I did receive fair speechless *messages.* *Id.*

Yon grey lines,
That fret the clouds, are *messengers* of day.
Id.

Evermore, when God's *messengers* are abandoned destruction is near. *Bp. Hall.*

The earl dispatched *messengers* one after another to the king, with an account of what he heard and believed he saw, and yet thought not fit to stay for an answer. *Clarendon.*

Gently hast thou told
Thy *message*, which might else in telling wound,
And in performing end us. *Milton's Paradise Lost.*

The welcome *message* made, was soon received;
'Twas to be wished and hoped, but scarce believed.
Dryden.

Let the minister be low, his interest inconsiderable, the world will suffer for his sake; the *message* will still find reception according to the dignity of the *messenger.* *South.*

Joy touched the *messenger* of heaven; he stayed
Entranced, and all the blissful haunt surveyed.
Pope.

MESSALINA (Valeria), a daughter of Messala Barbatus. She married the emperor Claudius, and disgraced herself by her cruelties and incontinence. Her husband's palace was not the only seat of her lasciviousness, but she prostituted herself in the public streets, and few men there were at Rome who could not boast of having enjoyed the favors of the impure Messalina. Her extravagances at last irritated her husband, who commanded her to appear and answer all the accusations which were brought against her; upon which she attempted to destroy herself; and, when her courage failed, one of the tribunes

who had been sent to her despatched her with his sword. Juvenal says of her,

Et lassata viris necdum satiata, recessit.

MESSANA, in ancient geography, the first town of Sicily on crossing over from Italy, situated on the strait now called the Faro (Italicus); anciently called Zancle, according to Diodorus Siculus, from king Zanclus; or, as others say, from the Sicilian word zanclon, a sickle, from the curvity of the coast: and hence zanclæi, the people.—Herodotus, Pausanias. Messana is derived from the Messenii of Peloponnesus.—Strabo. Thucydides ascribes its origin to Anaxilus, the Messenian, tyrant of Rhegium, who received all comers, calling the town after the name of his country. The Greeks always called it Messene; the Romans Messena constantly, to distinguish it from Messene of Peloponnesus. It is now called Messina.

MESSENA, or MESSENE, an inland town, and the capital of Messenia, a country of Peloponnesus; erroneously placed by Ptolemy on the coast. It was built by Epaminondas, who recalled all the Messenian exiles, and gave the town the name of Messene. It vied, in point of strength and situation, with Corinth, according to Strabo; and therefore Demetrius Phalereus advised Philip II. that, if he wished to have Peloponnesus in his power, he should make himself master of these two towns, as thus he would have the ox by both horns.

MESSENGERS are certain officers chiefly employed under the direction of the secretaries of state, and always in readiness to be sent with all kinds of despatches, foreign and domestic. They also, by virtue of the secretary's warrant, take up persons for high treason, or other offences against the state. The prisoners they apprehend are usually kept at their own houses, for each of which they are allowed 6*s.* 8*d.* a-day by government: and, when they are sent abroad, they have a stated allowance for their journey, part of which money is advanced for the expense of their journey. They have also a standing salary.

MESSENIA, a country in the south of Peloponnesus, mostly maritime, situated between Elea on the west, and Laconica to the east. Anciently a part of Laconica under Menelaus, and called Messene by Homer; interpreted by the scholiast Messenæa Regia. This country is famous in history, on account of the resistance made by the Messenians to the Spartans, and the exploits of their hero, Aristomenes. The first hostilities commenced about A. A. C. 652. Though inferior in the knowledge of the art of war to the Spartans, yet, by keeping for some time on the defensive, they so much improved themselves, that in three years they were able to give battle to their enemies in the open field; nor did they appear to be in any degree inferior either in courage or conduct; the war was therefore continued, with various success on both sides. At last both consulted the oracle at Delphi; and received for answer, 'that whoever should first dedicate 100 tripods in the temple of Jupiter at Ithome, a strong hold of the Messenians, should be masters of the country.' The inhabitants of Messenia, on hearing this, having no money to make the tripods of brass, began to cut them in wood; but before this could be accomplished, a Spartan, having entered into the city by stratagem, dedicated 100 little tripods of clay: on which the Messenians submitted to the Spartans. But they were treated with so much barbarity by these tyrants, that a new war commenced under Aristomenes, a man of invincible valor, and enthusiastically fond of liberty. He perceived that the Argives and Arcadians, who acted as allies of the Lacedæmonians, adhered to them only through fear, and in reality hated them, and wished to revenge the injuries they had done them. To these Aristomenes applied; and, receiving an answer conformable to his wishes, he engaged his countrymen unanimously to take up arms. About a year after, and before either party had received any auxiliaries, the Spartans and Messenians met at the village Deræ, where an obstinate engagement ensued. Aristomenes in this contest so distinguished himself, that his countrymen unanimously saluted him king; which title he, however, waived, alleging that he took up arms to set them free, and not to make himself great: he however accepted the title of general, with a power of doing whatsoever he thought requisite for the service of the public. As it now appeared that this war would be long and bloody, the Spartans again sent to enquire of the oracle concerning its event: the answer was, That it behoved the Spartans to seek a leader from Athens. The Athenians, naturally envious of the Spartans, granted their request, but in such a manner as manifested their hatred; for they sent them for a general Tyrtæus, a schoolmaster and poet, and lame of one foot. Meantime, Aristomenes had drawn together a large army; the Eleans, Argives, Sicyonians, and Arcadians, having sent troops to his assistance; the Spartans having no ally but Corinth. The Spartan kings, however, offered the enemy battle, which Aristomenes readily accepted. It was obstinate and bloody, but the Messenians were victorious, and the Spartans put to flight with great slaughter. Tyrtæus now convinced them that he was capable of fulfilling the promises made by the oracle; he encouraged them by his poems, directed them by his counsels, and recruited their broken armies from among the Helotes. Aristomenes, on the other hand, acted with no less prudence and vigor. He led out the Messenians, to act offensively against their enemies; and, entering Laconia, took and plundered Pharæ, putting all who resisted to the sword, and carrying off an immense booty. The Spartans sent immediately a body of forces to overtake the Messenians, but Aristomenes routed these pursuers, and continued to slaughter them, till he was disabled by a wound in his side, which occasioned his being carried out of the battle. His cure being finished, he resolved to carry the war to the gates of Sparta; but, whether he found his design impracticable, or was influenced by some dream, he gave out that Castor, Pollux, and Helena, had appeared to him, and commanded him to desist. Soon after this, going with a small party to make an excursion, and attempting to seize some women who were celebrating religious

rites near Egila, a village in Laconia, those zealous matrons fell upon him and his soldiers with such fury, that they put them to flight, and took him prisoner; but he soon after escaped, and rejoined his forces. In the third year of the war, the Spartans with a great force entered Messenia, whither Aristocrates king of Arcadia was come, with a great body of troops, to their assistance; but the Spartans bribed him to betray his confederates. When the battle began, the deceitful Arcadian represented to the forces under his command the danger they were in, and the great difficulty there would be of retreating into their own country, in case the battle should be lost: he then pretended that the sacrifices were ominous; and, having thus terrified the Arcadians, he not only drew them off from both wings, but in his flight forced through the Messenian ranks, and put them also in confusion. Aristomenes and his troops defended themselves the best way they could; but the Spartans surrounded them on all sides; so that most of their army and chief nobility were cut to pieces. Aristomenes, with the remains of his shattered forces, retired, and, perceiving that it was now impossible to maintain the war against the Lacedæmonians upon equal terms, he advised his countrymen to fortify mount Era, and to make the best dispositions possible for a long defence. He likewise placed garrisons in Pylus and Methone on the coasts; and to these three places he gathered all the inhabitants, leaving the rest of Messenia to the mercy of the Spartans. They, considering the war as now finished, divided the lands among their citizens, and caused them to be carefully cultivated, while they besieged Era. But Aristomenes quickly convinced them that the war was far from being over: he chose out 300 men, with whom he ravaged all the adjacent country; carried off a prodigious booty; and, when Messenia could no longer supply the wants of his garrison, penetrated into Laconia, and bore away corn, wine, cattle, &c., for the subsistence of his countrymen in Era; so that at last the Spartans issued a proclamation, forbidding the cultivation, not only of the Messenian territory, but also of Laconia in its vicinity; whereby they distressed themselves more than their enemies, inducing at last a famine in Sparta, with its usual attendant, sedition. Here the wisdom of Tyrtæus again supported the Spartan courage; and influenced them to continue the blockade of Era, and maintain a flying camp for the security of the country. Aristomenes, however, still committed terrible depredations with his small corps of 300 men. Among other places which he plundered was the city of Amyclæ; whence he carried off a great quantity of riches, and many carriages laden with provisions. The Spartan kings, as soon as they heard of this expedition, marched after Aristomenes, and, as the Messenians were encumbered with their booty, came up with them before they could reach Era. In this situation, Aristomenes, prompted rather by despair than prudence, made a long and vigorous resistance against the whole Lacedæmonian army. At length, however, numbers prevailed; the greatest part of the Messenians were slain on the spot; and Aristomenes, with about fifty of his men who survived, were taken prisoners; that chief having received so many wounds that he was senseless when they carried him away. The Lacedæmonians expressed the utmost joy at the sight of this illustrious captive; who, for so many years, by his single abilities, had enabled his exhausted country to defend itself against the whole force of Sparta. When he was recovered of his wounds, they barbarously decreed him and all his fellow-prisoners, to be thrown into a deep cavern, the common punishment of the lowest offenders. Three days he continued in this dismal place, lying upon, and covered with, dead bodies. The third day he was not only almost famished, but nearly suffocated with the stench of corrupted carcases, when he heard a fox gnawing a body near him. Upon this, perceiving the fox just by him, he, with one hand, seized one of its hind legs, and, with the other, defended his face, by catching hold of its jaw when it attempted to bite him. Following as well as he could his struggling guide, the fox at last thrust his head into a small hole, and soon forced his way through, and opened a passage to the welcome rays of light. Feeble as he was, Aristomenes wrought an outlet with his nails; and, travelling by night with all possible expedition, at length arrived safe at Era, to the great joy and amazement of his countrymen. His escape was at first hardly credited; but he soon put the truth of it beyond all doubt, by falling on the posts of the Corinthians, who had a considerable body of troops before Era. Most of their officers, with a multitude of private men, he slew, and pillaged their camp; and, in short, did so much mischief, that the Spartans, under the pretence of an approaching festival, agreed to a cessation of arms for forty days, that they might have time to bury their dead. On this occasion Aristomenes, for the second time, celebrated the hecatomphonia, or the sacrifice appointed for those who had killed 100 of the enemy with their own hands. He had performed the same before and after his second battle; and he lived to do it a third time. But, notwithstanding this truce, certain Cretan archers, in the service of the Spartans, seized Aristomenes as he was walking without the walls, and carried him away a prisoner. There were nine of them in all; two of them immediately flew with the news to Sparta, and seven remained to guard their prize, whom they bound, and conducted to a cottage inhabited only by a widow and her daughter. The young woman had dreamed the night before, that she saw a lion without claws, bound, and dragged along by wolves; and that she having loosed his bonds, and given him claws, he immediately tore the wolves to pieces. As soon as Aristomenes came into the cottage, and her mother, who knew him, told her who he was, she instantly concluded that her dream was fulfilled; and therefore plied the Cretans with drink; and, when they were asleep, took a poniard from one of them, cut the thongs with which Aristomenes was bound, and then put it into his hands. He presently verified her vision, by putting all her guards to death; and then carried her and his mother to Era, where, as a reward for her service, he married the young woman to his son Gorgus,

then about eighteen years of age. When Era had held out nearly eleven years, it fell into the hands of the Spartans by an accident; the servant of one Empiramus, a Spartan commander, driving his master's cattle to drink at the river Neda, met frequently with the wife of a Messenian, with whom he had an amour; and by means of whose husband he learned, that, Aristomenes being detained in his bed by a wound, the soldiers, knowing that he could not walk the rounds, had a grant to retire to their houses, to avoid the inclemency of the season. The Spartan no sooner heard this, than he hastened away to carry the news to his master. The kings were then absent from the camp, and Empiramus had the chief command of the army. As soon as he received this information, he ordered his army to begin its march, though it rained excessively, and there was no moon-light. They seized all the Messenian posts, and, as soon as it was light, the attack began; and Era had been quickly taken, if only the men had defended it; but the women fought with such fury, as made the event doubtful. Three days and two nights this desperate engagement lasted; at last, all hopes of preserving the city being lost, Aristomenes drew off his wearied troops. Early the fourth morning, he disposed the women and children in the centre, the Messenian youth in the front and rear, the less able men in the main body; himself commanded the van; the rear-guard was brought up by Gorgus, and Manticlus, the son of Theocles, a Messenian of great merit, who fell with much glory in this attack. Aristomenes then caused the last barrier to be thrown open, and began to march directly towards the Spartan troops, to force a passage. Empiramus, perceiving his intent, ordered his men to open to the right and left, and give them a passage; so that Aristomenes marched off in triumph to Arcadia. The Arcadians, when they heard that Era was taken, were very anxious to assist their old allies, and entreated their king Aristocrates to lead them into Messenia. But he, corrupted by the Spartans, persuaded them that it was too late; that the Messenians were all cut off; and that such a step would only expose them to the fury of the conquerors. However, hearing that Aristomenes was on the frontiers of Arcadia, they went in crowds to carry him provisions, and to testify their readiness to afford him and his troops all possible assistance. Aristomenes desired to be heard before a general assembly; which being convoked, he proposed one of the boldest schemes recorded in history; he said, that he had yet 500 undaunted soldiers, who, at his command, would undertake any thing; that it was probable most of the Spartans were employed in pillaging Era, and that therefore he determined to march and surprise Sparta; which appeared so plausible, that all the assembly commended his unshaken courage. Aristocrates, however, by various pretences, retarded the execution of the project. The Arcadians, who began to suspect him, surprised the messengers as they came back, seized the letters, and read them openly in the assembly. The purport of them was, that the Spartans acknowledged his great kindness, and promised that they would be grateful. Upon this the Arcadians stoned the king while Aristomenes stood with his eyes fixed on the ground, and shed tears to see him so deservedly put to death. The Arcadians afterwards erected a monument to perpetuate his infamy. The Messenians under Gorgus and Manticlus passed over into Sicily; where they founded the city of Messene. Aristomenes remained, however, in Greece, where he married all his daughters, except the youngest, to persons of rank. A prince of Rhodes, enquiring of the oracle at Delphi whom he should espouse, that his subjects might be happy under his posterity, was directed to marry the daughter of the most worthy of the Greeks. He therefore demanded and received the virgin daughter of Aristomenes, Aristomenes himself accompanying him back to his dominions, where he formed a scheme of uniting the Lydians and Medes against the Spartans, resolving with this view to go into Media, and to the court of Sardis; but meanwhile death surprised him, and thereby freed the Spartans from one of the most formidable enemies they ever had.

MESSI'AH, *n. s.* Heb. משיח, of משח, to anoint; Gr. *μεσσιας*. The Christ; the anointed Saviour of the world.

And after the end of the said four hundred and thirty-four years, from the restitution of the temple, shall the *Messiah* be slain, not for any cause that shall be found in him, but for the sins of men.

Bp. Hall.

Great and public opposition the magistrates made against Jesus, the man of Nazareth, when he appeared as the *Messiah*. *Watts.*

MESSIAH, Heb. משיח, signifies one anointed, or installed into an office by unction. It was usual among the Jews to anoint kings, high-priests, and sometimes prophets, at the designation or instalment of them, to signify emblematically the mental qualifications necessary for discharging these offices. Saul, David, Solomon, and Joash, kings of Judah, received the royal unction; Aaron and his sons received the sacerdotal; and Elisha, the disciple of Elijah, received the prophetic unction.—The name Messiah was given to the kings and high-priests of the Jews. The patriarchs and prophets are also called Messiahs, or the Lord's anointed. See 1 Sam. xii. 3, 5; 1 Chron. xvi. 22; Psalm, cv. 15. Thus this name Messiah was principally, and by way of eminence, given by the Jews to their expected great Deliverer; and is a name the Christians apply to Jesus Christ (χριστος) in whom the prophecies relating to the Messiah were accomplished. The sum of these prophecies is, That there should be a glorious person named Messiah, descended from Abraham, Isaac, and Jacob, who should be born at Bethlehem, of a virgin of the family of David, then in its decline, before the Jews ceased to be a people, while the second temple was standing, and about 500 years after Ezra's time; who, though appearing in mean circumstances, should be introduced by a remarkable forerunner, whose business it should be to awaken the attention and expectation of the people. That this illustrious person should himself be eminent for the piety, wisdom, and benevolence of his character, and the miraculous works he should perform; yet that, notwithstanding all this, he should be rejected and put to death by

the Jews: but should afterwards be raised from the dead, and exalted to a glorious throne, on which he should through all generations continue to rule, at the same time making intercession for sinners. That great calamities should be brought on the Jews for rejecting him; whereas the kingdom of God should by his means be erected among the Gentiles, and extended unto the ends of the earth; wherever it came destroying idolatry, and establishing true religion and righteousness. In a word, that this glorious person should be regarded, by all who believed in him, as a divine teacher, an atoning sacrifice, and a royal governor; by means of whom God would make a covenant with his people, very different from that made with Israel of old; in consequence of which they should be restored to, and established in, the divine favor, and fixed in a state of perpetual happiness. The Jews still wait for the coming of the Messiah, being infatuated with the notion of a temporal prince, who is to be a mighty conqueror, and to subdue all the world; a delusion in which we regret to see them encouraged by some modern Christian interpreters of prophecy. Many modern rabbies, according to Buxtorf, believe that the Messiah is already come, but that he keeps himself concealed, and will not manifest himself because of the sins of the Jews. Some of the Jews, however, to reconcile those prophecies that seem to contradict each other as to the character and condition of the Messiah, have had recourse to the hypothesis of two Messiahs, who are yet to succeed each other; one in a state of humiliation and suffering; the other of glory, splendor, and power. The first, they say, is to proceed from the tribe of Ephraim, who is to fight against Gog, and to be slain by Annillus. Zech. xii. 10. The second is to be of the tribe of Judah, and lineage of David, who is to conquer and kill Annillus, and restore the kingdom of Israel, reigning over it in the highest glory and felicity. Jesus Christ asserts himself to be the Messiah, in John iv. 25. Several impostors have endeavoured to pass for Messiahs, as Christ himself predicted. J. Lent, a Dutchman, has written a history De Pseudo-Messiis, Of False Messiahs. The first he mentions was one Barcochab, who appeared under Adrian. The last was rabbi Mordecai, who began to be talked of in 1682. A little before him, viz. in 1666, appeared Sabbathei Sebi, who was taken by the Turks, and became a Mahometan. The most valuable modern publication, on the subject of the Messiah whom the Old Testament teaches us to expect, is Dr. J. P. Smith's Scripture Testimony to the Messiah, 2 vols. 8vo.

MESSINA, a celebrated city in the north-east of Sicily, standing on a strait called the Faro di Messina. This separates Italy from Calabria, and is opposite to the city, only from two to three miles wide. The town runs parallel with it, forming an oblong of more than two miles in length, and from a quarter to half a mile in breadth The finest part is the Marina, a long line of buildings facing the harbour; for more than a mile it is connected with a broad quay. This noble range of buildings was begun by the government so long ago as 1622, and was intersected by nineteen openings, leading to the same number of small streets, each entered by a gate. All the buildings suffered much by the earthquake of 1783; but it has risen from its ruins, and is again a beautiful promenade. Several lofty and rugged mountains rise behind: the town forms a fine sweep along these eminences, and rises in gradation, so as to present almost every public edifice distinctly. The whiteness of the buildings forms a beautiful contrast to the dark green of the forests, while the lower grounds are strewed with cottages and villages. Nothing can exceed the coup d'œil of the whole about a mile at sea. Since the great convulsion in 1783 the town has been rebuilt with great regularity, and several of the streets have been widened. Next to the Marina, the principal streets are the Via Nuova and St. Ferdinand, decorated with fountains, statues, and other objects of interest. The inner part of the town, formerly dirty, is now much improved, and the pavement is of lava cut into flags. Two rapid streams from the mountains traverse the town, and are confined by stone walls to prevent their overflowing.

The public buildings consist of thirty fine convents for both sexes, a hospital, four seminaries of education, six asylums for the poor, and two Monti di Pieta, or loan banks. The convents are richly ornamented, and possess considerable revenues. Here are also four libraries; a noble public prison; and fifty great and small churches, among which are several beautiful buildings, containing a number of admired paintings. The cathedral has a fine Gothic front, and a granite pillar which supports the roof, taken from the ruins of the temple of Neptune. The royal palace, the senate-house, and the episcopal palace, are also buildings of note.

The harbour of Messina is said to be the finest in the Mediterranean; and consists of a bay, which has the city along its west shore; on the east is a tongue of land, the point of which turns inward, so as to form an inlet (a quarter of a mile across) sufficiently wide for the ingress of fleets, and narrow enough to protect the enclosed waters from the storms of the sea. The circumference of this harbour is from four to five miles; and its depth in general not less than forty fathoms. It is defended by a strong citadel. Of the Faro wine, not less than 10,000 pipes are said to be shipped here annually. Other exports are corn, oil, fruit, and the various productions of Sicily. Silk-worms have long been cultivated: and there are several extensive manufactures of silk in the city, which supply a large proportion of its exports to the Levant. The imports consist chiefly of colonial produce and British manufactures.

Messina is of great antiquity, having been known both to the Romans and Greeks, and is remarkable for its misfortunes. It has been at different times called Zancle, Mamertina, Messana, &c. Allured by the advantages of its situation, the Cumæans, a commercial and enterprising people, invaded the island, and drove the Siculi from this settlement; they were in their turn overpowered by a band of Samian adventurers, who made way for a colony of citizens of Messene, and under these masters it changed its name to Messana. Their government was of short duration; for, in A. A. C. 289, it was de-

stroyed by the Mamertines, a warlike unprincipled nation, inhabiting the south part of Brutium.

These soldiers being received into Messina on their return to Italy from Syracuse, where they had served as mercenaries in the army of Agathocles, massacred the inhabitants, and usurped their possessions. The city was now called Mamertina: and, to support themselves against the resentment of the Sicilian powers, the Mamertines implored the protection of the Romans, who, eager to extend their dominion beyond the limits of Italy, and jealous of the growing power of Carthage, assisted these assassins with a consular army. This step brought on the first Punic war. The Mamertines reaped no other fruit from the alliance, but a more honorable degree of slavery. Messina was, however, always distinguished by particular attention and favors from the senate; and, excepting a short period during the wars of the triumvirate, appears to have tasted all the sweets of Roman prosperity, with but little mixture of adversity. Its fate, in the ruin of the empire, was similar to that of the rest of Sicily. In 829 it fell into the hands of the Saracens, but obtained very honorable terms of capitulation; for half the city was left to the Christians, where they were to be governed by their own laws, and profess their own religion undisturbed. In the other resided the bey of one of the five provinces, into which the Arabian conquerors had divided the island. Notwithstanding this indulgence, Messina was the first to cast off the yoke in 1037, when George Maniaces landed an army of Greeks and Normans on the shore of the Faro. It afterwards held out against the whole Mussulman force, till the feeble state of a distracted empire shut out all hopes of assistance from Constantinople. This unfortunate city then opened its gates to the army of the caliph, and felt very severely the weight of his resentment; but it did not long groan under the yoke; for, in less than twenty years, Roger the Norman took it by surprise, and delivered it from Mahometan oppression.

During the crusades, Richard I. of England, and Philip Augustus of France, wintered here in their way to Palestine. The Messinese were particularly tardy in entering into the national conspiracy of 1282, but afterwards exceeded the rest of the insurgents in deeds of cruelty. This, and the importance of their situation, pointed them out as the first objects of Charles's vengeance. He invested their city very closely, and declared so openly his determination to refuse all terms whatever to the besieged, that they saw no hopes of safety but in an obstinate defence. Their courage, perseverance, and sufferings, were excessive; at length their strength and resources began to fail rapidly, and every circumstance seemed to denounce their speedy destruction, when Roger Lauria appeared off the harbour with the Arragonian fleet, forced the king to retire with precipitation across the straits, and in his sight defeated and destroyed his naval armament. Robert, grandson of Charles I., also made a fruitless attack; but in the disturbed reign of Frederick III. Messina was delivered up to Lewis king of Naples and his consort queen Joan, who entered it in triumph. In a few years it returned to its former possessors.

The year 1672 was remarkable for the revolt of the Messinese. They threw off the Spanish yoke, and swore allegiance to Louis XIV. of France. They were for some time vigorously assisted by the French; but before the Spaniards had gained the least advantage, to excite any hopes of recovering so valuable a possession. Louis found himself necessitated to desert his new subjects, and leave them to the mercy of their old incensed masters. The horror of being thus abandoned, and the chastisement inflicted by Spain, now broke their fierce spirit, and they were stunned with the remembrance and effects of this blow, when the plague in 1743 was introduced from the Levant, and swept away more than half the inhabitants. From this chain of calamities, the opulence, trade, and population of Messina, have never recovered.

In 1780 this city continued, for more than six months, to suffer from an earthquake. And again on the 5th of February, 1783, the air was heavy and calm; the sky obscured with thick clouds, and the atmosphere seemingly all in a flame. About half after twelve at noon, the earth began to shake, with a dreadful noise. The shocks continually increased, and became at length so violent as to open the ground, and to overturn in two or three minutes a considerable part of the buildings. A long white cloud appeared to the north-west, and soon after another, very dark, in the same quarter. The latter in a moment spread over the whole horizon, and deluged the city with rain and hail, accompanied with dreadful claps of thunder. The inhabitants fled in the utmost terror to the fields and ships. From mid-day till five P. M., the earthquake continued almost without interruption. The shocks then became less frequent. The cries of the dying; the shrieks of those half-buried under the ruins; the wild terror with which others, who were still able, attempted to make their escape; the despair of fathers, mothers, and husbands, bereft of those who were dearest to them; formed altogether such a scene of horror as seldom occurs in the history of the calamities of the human race. Amidst that awful scene, instances of the most heroic courage, and the most generous affection, were displayed. Mothers, regardless of their own safety, rushed into every danger to snatch their children from death. Conjugal and filial affection prompted deeds not less desperate and heroic. But no sooner did the earthquake cease, than the poor wretches who had escaped began to feel the influence of very different passions. When they returned to visit the ruins, to seek out the situation of their fallen dwellings, to enquire into the fate of their families, to procure food, and collect some remains of their former fortunes—such as found their circumstances the most wretched became suddenly animated with rage and despair. Property was violated, and murder, rapine, and robbery, reigned among the ruins. About one A. M., another shock of the earthquake was felt, which overturned most of the remaining houses. Those whom want, or

avarice, or humanity, still detained among the ruins, now shared the same fate with those whom the former shocks had buried under them.

The succeeding day scarcely alleviated the distress of this dismal night: the few wretches who still survived found themselves destitute of every necessary. At length order was in some degree re-established; and in two days after every person was supplied at least with some small portion of necessaries. None yet, however, thought of returning to take up their abode among the ruins. The people fixed their residence on the plains of Porta Salvo, near Salleo. The nobles, magistrates, and merchants, took up their abode on another plain, on the other side of the stream Porta de Legno; the soldiers at Terra Nuova. Some violent shocks on the 7th of February and 28th of March completed the destruction of the city. The corn magazines, however, escaped without damage; and the public ovens and the aqueducts were little injured. The neighbouring villages, having suffered but little, were the first to relieve the remaining inhabitants. Maltese galleys for some days brought provisions to the poor and the sick, with a generosity which merits the highest praise. They also brought surgeons with medicines, &c., for the cure of the wounded. The money needed for the support of the people was taken from the treasury of Messina; for what the king of Naples sent was seized and spent by the garrison.

About 900 persons perished by this earthquake. The sea during the convulsion was slightly agitated in the harbour. Farther out the sea was more violently agitated; but none of the ships in the harbour were dashed to pieces. The waters rose so high as to be injurious in a very considerable degree to Faro, as well as along the coast of Scylla and Bagnara. This earthquake was not of a momentary duration, like that by which Lisbon was destroyed: for more than sixty days, from the 5th of February to the beginning of April, Messina continued to be shaken; and in that time felt more than 200 shocks. Even after that period the alarm was again and again renewed. Of the church of Purgatory, only the walls were left standing. One half of the steeple of the cathedral was beaten to the ground. The magazines of Porto Franco were likewise very much shattered. The fort of St. Salvator, being built on an artificial foundation, the side next the sea fell down; but on the other side, where it is founded on a rock, it stood unmoved by the shocks. On the 5th of February, when the earthquake was most violent, a strong smell of sulphur was felt. The earth was affected somewhat as if it had been borne upon a fluid, and seemed to reel like a ship tossed with the waves. This tremulous motion was felt all over Sicily. On the following days the sky was cloudy; the mountains of Sicily and the shores of Calabria continued covered with a thick fog like smoke. North and north-east winds raged with the most violent impetuosity. This disastrous year was scarcely ended, when the elements again renewed their fury to ravage this miserable land. On Tuesday the 6th of January, 1784, about sun-rise, the wind began to blow softly from the north-east. The sea gradually swelled, rose beyond its bed with rapid impetuosity, overflowed the quay, and lashed the ruins of the Palazzata. It loosened and displaced many of the stones of the mole, spread over the whole street, and attacked the pedestals of the statues which had been spared by the earthquake, and still stood firm among the ruins. The same furious wind, which swelled the sea in so extraordinary a manner, ravaged the whole coast from Messina to Syracuse.

After this last calamity the inhabitants were exempted from the payment of taxes, for a period of twenty-five years, and their harbour was declared a free port; that is, a port for the deposit of all goods, free of duty, until taken out for consumption. Messina had the advantage of being the head-quarters of the British forces for several years prior to the peace of 1814. Population 36,000. Fifty miles N. N. E. of Catania, and 130 east of Palermo.

MES'SUAGE, *n. s.* Law Lat. *messuagium*, from *mansio*. The house and grounds of an estate set apart for domestic use.

By the name of *messuage* may a garden, shop, mill, cottage, chamber, cellar, or the like, pass. In Scotland, *messuage* denotes what we call the manor-house, viz. the principal dwelling-house within the barony.
Dr. A. Rees.

MESURADO, a river of Western Africa, which rises in the mountains of Kong, and falls into the Atlantic, at the western extremity of the Grain Coast. On its banks is situated a kingdom of this name, the boundaries of which are uncertain. It is populous, and well cultivated, and contains excellent wood for ship-building. The capital is situated about eight miles up the river.

META, in the Roman circus, was a pile of stones of a pyramidical form, intended as a boundary of the stadium, or chariot-course. When the meta was passed the seventh time, the race was concluded. The greatest art and management were required in avoiding the meta, and yet going as near it as possible. If they went too near they were in the greatest danger of breaking the chariot to pieces; and, if they took too large a circuit in the turn, they gave their rivals an opportunity of getting within them, besides losing a great deal of ground. The boundary of the Grecian stadium, or course, was called τελος, τερμα, γραμμη, and αηρα γραμμη to which last name Horace probably alludes in calling death, ultima linea rerum. The metæ at Rome were first of wood, afterwards of stone but the emperor Claudius gilded them. In the Roman circus there were two metæ, one at the entrance of the course, and the other at the end of it. An egg was placed on the top of the meta.

META, a large river in New Grenada, Colombia, which has its rise in the mountains opposite Santa Fe de Bogota, and flows through the province of San Juan de los Llanos, and the district of Casanare. It receives many other large rivers; and, being swoln to an immense size, falls into the Orinoco, about 450 miles from its source, in long. 67° 45′ W., lat. 6° 10′ 30″ N. Before entering the Orinoco, it forms such a smooth body of water, that its current is scarcely perceptible.

Its banks are chiefly inhabited by very barbarous Indians. In the province of Juan de los Llanos, the missionary villages are numerous on its banks.

METAB'ASIS, *n. s.* In rhetoric, a figure by which the orator passes from one thing to another.

METACAR'PUS, *n. s.* } Gr. μετακάρπιον.
METACAR'PAL, *adj.* } In anatomy, a bone of the arm made up of four bones, joined to the fingers: belonging to the metacarpus.

It will facilitate the separation in the joints when you cut the finger from the *metacarpal* bone.
Sharp's Surgery.

The conjunction is called synarthrosis; as in the joining of the carpus to the *metacarpus.*
Wiseman's Surgery.

METAGITNION, the second month of the Athenian year, answering to the latter part of July and beginning of August; so called from the metagitnia, which was kept in it. The Bœotians called this month Panemus, and the Syracusans Carnius.

METAGRAM'MATISM, *n. s.* Gr. μετα, change, and γράμμα, a letter. A transposition of the letters of a name.

Anagrammatism, or *metagrammatism*, is a dissolution of its name into its letters, as its elements, and a new connexion of it by artificial transposition, without addition, subtraction, or change of any letter into different words, making some perfect sense applicable to the person named. *Camden.*

METAL', *n. s.*
METAL'LIC, *adj.*
METAL'LIFEROUS,
METAL'LINE,
METAL'LIST, *n. s.*
METAL'LOGRAPHY,
MET'ALLURGIST,
MET'ALLURGY.

Fr. Span. and Port. *metal*; Ital. *metello*; Lat. *metallum*; Gr. μεταλλον; Heb. מטל. A mineral substance; characterised in general by a peculiar lustre. See CHEMISTRY, part IV., and below; also written for METTLE, which see: metallic and metalline mean partaking or consisting of metal or its qualities: metalliferous, productive of metal: metallist and metallurgist, a worker, or a person skilled in metals; metallography, an account or description of metals: metallurgy, the art of converting or working them.

A king that would not feel his crown too heavy for him must wear it every day; but, if he think it too light, he knoweth not of what *metal* it is made.
Bacon.

Metalline waters have virtual cold in them; put therefore wood or clay into smith's water, and try whether it will not harden. *Id.*

The ancients observing in that material a kind of *metallical* nature, or fusibility, seem to have resolved it to nobler use; an art now utterly lost.
Wotton's Architecture.

The mind of man is of a strange *metal*: if it be not used, it rusteth; if used hardly, it breaketh: briefly, it is sooner dulled than satisfied, with a continual meditation. *Bp. Hall.*

Being glad to find their companions had so much *metal*, after a long debate the major part carried it.
Clarendon.

Both kinds of *metal* he prepared,
Either to give blows or to ward;
Courage and steel both of great force,
Prepared for better or for worse. *Hudibras.*

It is curious to observe how the nature of truth may be changed by the garb it wears; softened to the admonition of friendship, or soured into the severity of reproof; yet this severity may be useful to some tempers; it somewhat resembles a file, disagreeable in its operation, but hard *metal* may be the brighter for it. *Mackenzie.*

Though the quicksilver were brought to a very close and lovely *metalline* cylinder, not interrupted by interspersed bubbles, yet, having caused the air to be again drawn out of the receiver, several little bubbles disclosed themselves. *Boyle.*

Metallists use a kind of terrace in their vessels for fining *metals*, that the melted *metal* run not out.
Moxon.

The lofty lines abound with endless store
Of mineral treasure, and *metallic* ore.
Blackmore.

METAL, in heraldry. There are two metals used in heraldry, by way of colors, viz. gold and silver, in blazon called or and argent. In painting of arms these metals are represented by white and yellow, their natural colors. It is a general rule in heraldry never to place metal upon metal, nor color upon color: so that if the field be of one of the metals, the bearing must be of some color; and if the field be of any color, the bearing must be of one of the metals.

METALLURGY.

METALLURGY. This important branch of chemical science has been diligently cultivated both in the north of Europe and America. The abundance of ore found in the mountainous districts of Great Britain has also induced commercial speculators to pay considerable attention to the subject; but still it must be admitted that, in a scientific point of view, we have done but little for this art.

The art of managing metallurgical processes, with skill and effect, is of the highest antiquity, though few of the metals offer themselves to our notice in a state calculated for domestic economy; and those, when they really occur, are found in small quantities and in few localities. It may be proper to add, that many of the ores have no appearances by which their metallic contents could be judged of. They differ, indeed, very materially in this respect: thus galena has much the appearance of the metal it contains; yellow copper has a metallic appearance, but not indicating the metal; tin and iron stone are exceedingly ponderous: whilst some ores and arseniates of copper have neither weight nor metallic lustre.

It has been ingeniously supposed by Mr. Muchet that iron might be accidentally produced in the operation of converting wood into charcoal. Tradition informs us that the discovery was owing to the accidental burning of a forest in Greece. Similar circumstances might, however, lead to the knowledge of other metals, particularly such as have ores easy of reduction, and which are often found near the surface of the earth, such as lead and tin.

In the fourth chapter of Genesis Tubalcain is mentioned as 'an instructor of every artificer in brass and iron.' Vallerius says that, as far as he knew, Pliny was the first who enumerated the seven metals; but they were certainly known long before his age, and were mentioned both by Homer and Moses. Indeed the former has several curious passages on the subject, while speaking of Vulcan, which describe his forges as urged by bellows, which must have been applied nearly in the same manner as we use them now.

Thus having said—the father of the fires
To the black labour of his forge retires;
Soon as he bid them blow the bellows turned
Their iron mouths, and where the furnace burned,
Resounding breathed; at once the blast expires,
And twenty forges catch at once the fires;
Just as the god directs, now loud, now low,
They raise a tempest, or they gently blow.
In hissing flames huge silver bars are rolled
And stubborn brass, and tin, and solid gold.
Before, deep fixed, the eternal anvils stand,
The ponderous hammer loads his better hand;
His left with tongs turns the vext metal round,
And thick strong strokes the doubling vaults rebound. *Homer. Iliad*, book xviii. line 537.

In the time of Abraham gold and silver were esteemed, as they are at present, precious metals (Gen. xxiii. 16. Gen. xiii. 2); and hence it is reasonable to conclude that Noah was able to instruct his descendants in the art of metallic ores. This art was afterwards lost among the various colonies which quitted the plains of Asia in search of settlements.

Virgil, in the eighth book of the Æneid, mentions the melting of steel in large furnaces as contrasted with others in which bellows were used. And commentators on these passages mention that the Latin name for steel (chalybs) was derived from that of a people in Spain, who were very expert in the working iron and its ores and mines.

We find some of the earliest specimens of weapons to be made of an alloy of copper with tin, which forms a metal almost as hard as steel, without, however, possessing the other valuable properties of the latter. There would be great probability in this being made before steel, and being applied to similar uses; but we are not without evidence on this head, as Hesiod expressly says, that in the early ages the arms and instruments of the primitive heroes were composed entirely of brass.

The Phœnicians, a people derived from the Canaanites, and whose existence, as a separate nation, ceased 600 or 700 years before Christ, were famous for many arts, such as weaving fine linen, making glass, and particularly are recorded as having extraordinary skill in working the metals. Their fame was high for taste, design, and ingenious invention, and their commerce so extended by their industry and knowledge, that their ships even reached this country, and visited Cornwall for the tin which they purchased there.

After the Phœnicians we find the arts which they possessed principally in the hands of the Egyptians, and that a considerable quantity of real chemical knowledge, which the possession of such arts would indicate, became mixed up, according to the custom of the country, with fable and hypothesis, and passed chiefly into the hands of their priests. This seems to have been the case even in the time of Pliny; it was, however, communicated probably to the Alexandrian Greeks among the famous mysteries of the time; and as the complicated economy of the Egyptian hierarchy declined, by the consequences of the Roman conquest and other causes, the knowledge of some of their arts became diffused into Europe, and with it the spirit that pervaded their philosophy. To this we may trace the study of alchemy, which has been called 'an art without art, the beginning of which is falsehood, the middle hard labor, and the end beggary.'

Such a summary condemnation ought not, however, perhaps to be passed on a pursuit, which at any rate has procured for after times much knowledge, merely because we, with superior information, can see the absurdity of many of its pretensions, or can detect the imposture of many of its professions. The principal object of the alchemists was to make gold and silver: they imagined a certain mysterious sympathy between the metals and the heavenly bodies of our solar system. The great intrinsic value of the principal metals naturally engaged a great portion of the attention of those who acquired chemical knowledge; and, finding in the pursuit of many experiments unlooked-for compounds and results, two dominant passions in the human mind were flattered—the love of scientific discovery, and the desire of gain. The golden age of alchemy commenced with the conquests of Arabian fanaticism in Asia and Africa, and the subjection of Europe to superstition and the most profound ignorance. From the tenth to the thirteenth century little is known concerning the state of alchemical studies; but about the latter period Albertus Magnus, Roger Bacon, and Raymond Lully, who were able men, raised the pursuit to a degree of credit which it little merited; and it is spoken of as the Hermetic philosophy, and sometimes as the holy or divine art. The fifteenth century exhibited the same combination of chemistry with alchemy; but the language of the professors was less obscure, and the great authors were, during that period, Hollandus (Isaac and John), George Ripley, and Basil Valentine.

In 1550 appeared the celebrated treatise De Re Metallicâ, by Georgius Agricola; who, though bewildered in his youth by the false philosophy of the times, made ample amends by this admirable work on metallurgy and mineralogy. Alchemy now gave way to the increase of knowledge, and to the effect of the experimental mode of philosophising which was introduced by the great Bacon, though a certain number of impostors and some credulous and honest dupes continued at intervals to pursue the glittering phantom. The labors of some alchemists were excessive, and their patience almost beyond belief: experiments were continued for months, and even years, and their repetitions of digestions, sublimations, and distillations, were almost without end. They supposed that there might be two methods to make gold,—by synthesis or composition, and by transmutation. For the first they labored to find out the elements of the metals, which they imagined would be some metallic earth, and some essence or spirit which they chose to call sulphur. They held a won-

derful opinion of what might be discovered in mercury, which seemed to them likely to possess hidden qualties analogous to what they hoped to find from its volatility, and as they thought its spiritual nature.

Another set directed their efforts to the attempt at changing the baser metals into gold, and made their experiments mostly for this purpose on lead and copper, attracted, probably, by the weight of the one and the color of the other. To effect this transmutation they imagined that it was only necessary to discover the true elixir, or medicine of metals, the tincture, the powder of projection, or philosopher's stone,—for by such names were their preparations called,—which they imagined would purge away the impurities which only caused the differences between the inferior metals and the perfect ones.

In all this there may, perhaps, be less absurdity than has been urged; the discoveries of modern chemistry have been as wonderful, and might have seemed as improbable, in a former state of knowledge; nor can we be surprised when they observed, for instance, that lead almost always contains a certain portion of silver, and that all metals were capable of improvement by refining processes, that such expectations were excited. At any rate it is admitted that, from the labors of many of these men, great progress was made in chemical research which was useful in many respects, and particularly enlarged the skill and experience of the metallurgists, as may be seen in the instance of Agricola.

Another class of alchemists directed their labors to find an elixir of life, by which all disease was to be removed from the human frame, and existence prolonged to an indefinite period; but this subject only merits notice here as it is connected with the introduction of metallic preparations into medicine, which is another benefit we have derived from these absurd speculations. Paracelsus and Van Helmont were the great authors of this branch of the art.

The following are such of the metals as are usually seen in their metallic state in the popular sense of the word; and those principally will be treated of which form the material of most of our metallurgic processes:—

1. Unalterable by fire, or not oxidable by heat; a property which formerly was supposed to characterise a perfect metal:
   - Gold, silver, platina, nickel palladium . . . } fusible and malleable.
   - Rhodium, iridium . . } granular and brittle.
2. Oxidable by heat; and, being thus converted into what was called a calx, formerly considered as imperfect:
   - Mercury, copper, iron, tin, lead, zinc, . . } malleable.
   - Bismuth, antimony, cobalt, manganese, tellurium, titanium, tantalium, . } brittle but fusible.
   - Uranium, osmium, . } infusible and granular.
3. Metals which are acidifiable:
   - Columbium, chrome, tungsten, molybdena, . } fixed.
   - Arsenic, . . . volatile.

One of the most remarkable characters of metallic substances is the peculiar lustre which their polished surfaces exhibit; and which, from its being eminently characteristic of these substances, has been called the metallic lustre. The next remarkable property of metals is their opacity, which, though very considerable, is by no means absolute as has been affirmed. Leaf gold will transmit a green light, and silver leaf a white light. Probably other metals would also be somewhat transparent if equally attenuated. In specific gravity the metals exceed all other known substances. Sulphate of barytes, the heaviest of earthy bodies, is less than four and a half times as heavy as water. The lightest metal (if we except sodium and potassium), is more than six times as heavy as water, and the heaviest (platina) is nearly twenty-three times as heavy.

The principal metals, arranged according to their specific gravities, stand as follows:—

1.	Platinum	21·00
2.	Gold	19·30
3.	Tungsten	17·50
4.	Mercury	13·50
5.	Palladium	11·50
6.	Lead	11·35
7.	Silver	10·50
8.	Bismuth	9·80
9.	Uranium	9·00
10.	Copper	8·90
11.	Arsenic	8·35
12.	Nickel	8·25
13.	Cobalt	8·00
14.	Iron	7·78
15.	Molybdenum	7·40
16.	Tin	7·30
17.	Zinc	7·00
18.	Manganese	6·85
19.	Antimony	6·70
20.	Tellurium	6·10
21.	Sodium	0·972
22.	Potassium	0·865

The fusibility of metals is a property that eminently contributes to their usefulness; for without this it would be impossible to separate them from the earths and other impurities with which they are naturally mixed; not to mention the vast advantage of producing useful forms by the simple operation of casting into moulds of any required shape. The range of temperature at which various metals become fluid extends from the highest degree that our furnaces can produce, to a degree of cold, hardly ever occurring naturally. Thus, platina is scarcely fusible in the greatest furnace heat; iron and some others require an intense white heat; gold, silver, and copper, a bright red or low white heat; antimony a low red heat; and tin, bismuth, lead, and zinc, melt from about 450° Fahrenheit, to a temperature just under a red heat; while mercury is fluid, unless it be in a state of cold equal to about 40° below zero.

At certain heats several of the metals may be volatilised, or driven off in the state of vapor, and it is not improbable that all may be so, if we could raise the temperature high enough. But a considerable difference exists in this respect; and advantage is taken of it in many processes of smelting and refining, of thereby

separating the one metal from the other; those which are called fixed metals remaining in the state of strong ignition without evaporation, and those which are called volatile rising in dense fumes. Mercury, arsenic, antimony, and zinc, are highly volatile. Lead, tin, and bismuth, are less so, but are evaporated in a strong fire; while gold, silver, copper, and iron, are not sublimed by any heat which we usually employ.

The next striking and valuable property is their extensibility. This by the ancients was reckoned one of the essential characters of metallic bodies, but has ceased to continue so in consequence of the discovery of a number of metals destitute of this quality. Its high importance, however, may be well judged of, by observing that, for almost all mechanical purposes, the intrinsic value of metals is intimately dependent on their extensibility. This property may be classed under two heads,—malleability and ductility: that is to say, metals may either be extended by hammering, when they are said to be malleable, or by lamellating when they are said to be ductile. The metal of the greatest malleability is gold, which may be beaten into leaves so thin that they will float in the air like a feather. Silver may be reduced to nearly the same state of tenuity. Gold leaf is estimated at a thickness of little more than $\frac{1}{300000}$th of an inch. Silver leaf is about $\frac{1}{160000}$th. After these may be ranked in the following order copper, tin, lead, iron, and zinc; this last, however, to be made perfectly malleable, must be made somewhat hotter than boiling water. The other malleable metals are platina, palladium, nickel, and mercury.

It might at first sight appear that the ductility of metals would follow the same order as their malleability, both properties being merely a mode of extension; but it is evident that the ductility of a substance is compounded of its malleability and tenacity. Hence iron, though by no means so malleable as tin or lead, greatly surpasses them in ductility. The tenacity of metal is estimated by the weight that will be required to break a wire of a given diameter. Thus it is stated that a wire of one-tenth of an inch diameter of

Iron will bear, before it breaks,	705 lbs.
Copper	387
Platina	351
Silver	239
Gold	191

The tenacity of tin is greatly inferior to that of gold, and the tenacity of lead is the least of all.

Metals, besides the properties described, have of course others common to matter in general, or to bodies differently constituted in other respects; and some on which depend both the uses we make of them, and the operations for making them useful. The most important are those of divisibility and penetrability, elasticity, affinity for each other, and affinity for other substances. By the first affinity they unite together, forming mixed metals, called alloys or amalgams. By the second they combine chemically with various substances which alter their character, and form ores, salts, oxides, carbonates, hydrates, glasses, or enamels.

From the properties of the metals we are naturally led to consider their uses, and the means by which they are converted into the various forms that contribute so largely to the useful and ornamental arts of life. In any state of society, however rude, we can hardly conceive of substances more desirable than the metals; and thus we see that among savage nations nothing is more coveted, and that a few nails will be exchanged for their most highly prized articles; while, in the history of the civilised world, we may observe that metallurgic processes were greatly esteemed and eagerly pursued, and proficients in the art by which the metals were worked were honored for their knowledge and enriched by their skill. The metals will appear, upon the slightest consideration of the subject, to form a principal ingredient in most operations conducive to our comfort, amusement, or improvement. Without them we can conceive of no fit instrument of agriculture, art, or scientific research. Their uses may be said to be both active and passive; for, while they furnish us almost entirely with the tools by which substances of every kind are moulded to their destined form, they are likewise in themselves a principal material to be worked upon. The copper plate which receives the most delicate forms that the engraver can portray, takes its impression from the hard and pointed steel. The various properties, then, which peculiarly render the metals applicable to so many purposes are (as before stated), peculiar lustre, opacity, specific gravity, fusibility, extensibility (including malleability and ductility), tenacity. Also those properties which they possess in common with other substances; such as divisibility and penetrability, elasticity, affinity for each other, and affinity for other substances.

1. From the first of these properties, the metallic lustre, and the susceptibility of polish, results not only all the brilliancy which delights the eye under so many varying forms and circumstances, but also the perfection of mirrors and of the specula which have so much improved our telescopes.

2. The specific gravity of the metals is attendant upon that solidity and strength which forms a very prominent quality in fitting them for many important uses. The density which thus belongs to them enables us to employ them for vessels which are to retain or conduct the most subtile vapors, such as steam and the gases; and, as it is combined with ductility, to confine and employ them in the full energy of highly expansive force.

3. The third property of the metals, fusibility, gives rise to the art of founding, by which forms are produced in endless succession, similar to any given pattern, and similar to each other, and without the labor of working them into shape by long continued exertion. It is only necessary to mention the great use that is now made of cast iron and brass, as instances of the application of this property. As a part of the fusibility of metals, welding may be noticed, which is a quality that some of them have of

uniting into a solid state by a partial fusion of the surfaces; thus wrought iron is joined together, or iron is united to steel, which enables the workman to produce many most useful combinations.

4. Of all the properties, perhaps, extensibility is the most extraordinary; and it adapts the metals most for uses for which substitutes could hardly be found. The following processes depend upon this property.—Forging; which is applied to iron, steel, and copper. Laminating or rolling; by which plates or sheets of many metals are produced, and by varying the process we obtain rods and bars. Wire-drawing is applied to metals which have considerable tenacity, and is accomplished by pulling rods successively through holes, each smaller than the foregoing. Pipes are formed of soft metals, such as lead, tin, and copper, by a somewhat similar operation. Coining is an art also dependent on the ductility of metals, and seems to have been very anciently practised. A similar process applied to thin plates of metal is called stamping, by which many beautiful forms in plated goods and brass ornaments are produced. Plating, particularly of silver, upon copper or brass, is principally performed by applying the two metals to each other, and laminating them together, so that a perfect contact is produced. And gilt wire is formed by drawing a rod of silver which has been coated with gold, and by which the latter metal is attenuated to an almost incredible degree. The tenacity of metals makes them most suitable for many important purposes; such as chains, wires, steam-boilers, and other strong vessels, guns, &c.

5. By taking advantage of their penetrability, and their different degress of hardness, we avail ourselves of all the purposes which may be attained by the processes of turning, boring, filing, cutting or chipping, often called chasing, planing, engraving, polishing, and grinding.

6. The quality of elasticity, which many metals possess in a remarkable manner, gives us a great variety of our best springs for various important purposes; and under the same head we may arrange the use of metal for musical strings, or wires and bells.

7. From the affinity of the metals for each other we derive the power of making many compounds called alloys, and which either possess qualities intermediate between their constituents, or often differing from both; thus rendering it possible for us, if we do not find a metal suited to our purpose, to compound one adapted to particular uses. In noticing the principal alloys, it is to be observed, that gold and silver are hardened, so as to be more useful than they would be in their pure state, by the mixture of a little copper. Copper affords us many valuable alloys; as with zinc, brass; with tin, gun-metal, bell-metal, or bronze, and speculum metal; with tin and lead, pot-metal. Tin, alloyed with lead, forms the common solder used by plumbers; and also with a proportion of antimony and a small quantity of lead gives pewter. Lead and antimony form type metal, which has the requisite qualities of fusiblity and considerable hardness. Shot is made of lead mixed with a small quantity of arsenic. Iron is seldom alloyed with other metals, but steel has lately been mixed with minute portions of silver, platina, rhodium, &c., which are said to improve its quality. Bismuth (eight), lead (five), and tin (three), form an alloy so fusible as to melt in boiling water; though no one of these metals separately will melt under a temperature of 450°.

Amalgams are combinations of mercury with other metals, which in many instances readily take place even without the assistance of heat; the mercury producing in this case a kind of solution of the other metals. Use is made of this circumstance to separate gold and silver from the other substances with which they are mixed in the earth. Amalgams are employed for many purposes. That of gold is used in gilding; and silvering is performed in a similar manner in some instances. The amalgam of tin is used in silvering (as it is called) the backs of looking-glasses or mirrors. Another use made of the affinity of one metal for another is the coating applied to the surfaces by immersion. Thus the common tin-plates which are so much in use are made of sheet iron, dipped in melted tin, which, with proper treatment, combines with a portion of the iron and adheres to it. Copper for culinary vessels and many other purposes is tinned in nearly a similar manner.

Soldering is another instance of the use made of this affinity. It is performed by applying a metal, or an alloy, more fusible than the one the parts of which are to be united. The solder is easily melted without disturbing the form of the metal worked on; and, combining in some degree with it, makes a perfect joint.

Tin alloyed with lead makes a solder for lead and tin.—Zinc and a little copper, called spelter, makes a solder for copper and brass.—Brass makes a solder for iron.

8. From the affinity of the metals for other substances, and the ease with which they combine chemically with them, we derive a great number of substances most important to the arts, to medicine, and almost every purpose of life.

With oxygen the metals readily unite, and the metallic appearance and properties are lost, and a class of substances formed, which were at one time called calces, but are now more appropriately denominated oxides.

Iron with oxygen forms rust.

Lead with oxygen forms litharge, red-lead, and massicot.

Copper with oxygen forms scales and red oxide.

Mercury with oxygen forms substances which are important in medicine; such as precipitate per se, red precipitate.

Tin with oxygen forms enamel or glaze. Putty powder used in polishing. Black oxide is the ore.

Antimony with oxygen gives oxides used in medicine.

Arsenic with oxygen forms the poisonous state of this metal.

Manganese is principally useful from the large quantity of oxygen combined with it in its most common form. The metals very readily also unite with sulphur, and form many useful

compounds. Mercury gives a beautiful pigment called cinnabar or vermilion. Antimony gives some important medicines. Bismuth gives a cosmetic, pearl white, or blanc de fard. Carbon forms an important compound with iron in the article of steel; and plumbago is also a small proportion of iron with a large proportion of carbon.

The beautiful art of enamel-painting, with the colors given to our porcelain and glass, are to be referred to the combinations which take place between the metallic oxides and siliceous earth in a state of vitrification. Some of the oxides act powerfully as a flux in promoting the fusion of siliceous earth when it is converted into glass; and those of lead and arsenic (but particularly the former) are much employed in the manufacture of flint glass, and communicate no color to it. Other metallic oxides, however, combine this with silex, imparting to it a variety of delicate and transparent colors, which are used in the arts above mentioned.

Oxide of gold,	Fine purple.
Oxide of iron,	Common reds.
Oxide of silver, lead, and antimony,	Yellow.
Oxide of copper, chrome,	Green.
Oxide of cobalt.	Fine blue.
Oxide of manganese,	Violet.
Oxide of tin,	White.

The fabrication of imitative gems is dependent on the same circumstances, and the color of real gems may also be attributed to metallic mixtures.

Another numerous class of substances originating from the affinity of metals with other substances are the metallic salts, generally resulting from the combination of metals and acids. The list, if completely detailed, would extend to a great length. The following are some of those most commonly employed in the arts:—

Carbonates of lead,	White lead.
Carbonates of copper,	Verditer.
Sulphates of copper,	Roman vitriol.
Sulphates of iron,	Green vitriol, copperas.
Sulphates of zinc,	White vitriol.
Nitrates of silver,	Lunar caustic
Muriates of mercury,	Calomel and corrosive sublimate.
Muriates of tin,	Sal Jovis, used in solution in dyeing.
Acetates of copper,	Verdigris.
Acetates of iron,	Iron liquor.
Acetates of lead,	Sugar of lead.
Prussiates of iron,	Prussian blue.
Gallates of iron.	Ink, black dyes.

It has been shown that the metals readily combine with a variety of substances, and that in this state of combination they lose more or less of their metallic characters. In their natural state they are most usually thus combined, and the substances in union with them are called mineralizers. These consist of certain simple substances, some acids, water, and even some metals. Under these heads may be enumerated, as commonly occurring in natural combination with the metals

Oxygen.	Sulphuric acid.
Sulphur.	Muriatic acid.
Silex.	Phosphoric acid.
Carbonic acid.	Chromic acid.
Arsenic acid.	Molybdic acid.
Water.	Arsenic.

The result of the natural combination of these substances with metals, is called an ore.

Metallic ores are further compounded by including mixtures of more than one metal, as in the case of yellow copper ore, which contains both sulphuret of copper and of iron; galena, or sulphuret of lead, which commonly contains silver; and many ores which contain arsenic combined with other metals. Again, the metallic ores are much intermixed with earthy substances of various kinds, which, though not in chemical union, have often such an intimate mechanical union as to alter their character and add to the variety of their appearance, and to the difficulty of extraction of the pure metal.

Some of the compounds, which have been before described as the products of art, will appear again in the list of the ores; but generally speaking, owing to the circumstances of other admixtures, or their having been formed in modes which art cannot imitate, their external characters are different in the one case from what they are in the other. One peculiarity which will strike us is the variety of form and the splendor of their crystals, each assuming a regularity in their structure which forms an admirable guide by which their nature may be detected; and this circumstance has been used as the foundation of a study that has rendered the greatest services to mineralogy; it has assumed the name of crystallography, and should be attended to by all who intend to acquire a knowledge of the mineral kingdom. Besides the ores resulting from combinations such as have been mentioned, certain metals are found in their pure or malleable state, and we speak of them then as native metals, such are,

Platina, gold,	Almost always.
Silver mercury, copper, antimony,	Frequently.
Arsenic, tellurium, bismuth, iron,	Rarely.

Taking then into account these and the compounded state of the ores, it will appear that nature presents us with the metals under a great variety of form, exciting us to careful examination and diligent skill in their discovery, reduction, and adaptation to our wants. It will hereafter be shown that the art of reducing the metals depends upon our power of destroying these combinations, occasionally by presenting other affinities, but in all practical cases assisted by fire. The precipitation of copper, from solution by iron, affords an instance, however, of a metal being produced into its metallic state from its compound form without the aid of heat.

The metallic ores, as is well known, are not the produce of all countries, but are limited to situations in which are found certain rocks which enclose them, and which are therefore termed metalliferous rocks. These occur only in several parts of the world, and in these places only can we

expect a supply of the metals. England at present holds a distinguished place in the list of mining countries; our produce of iron, copper, lead, and tin, is greater than of any other country, and we also possess considerable quantities of zinc and manganese, with a proportion of others, such as arsenic, antimony, cobalt, and silver, and occasionally small quantities of gold.

The iron-works of Great Britain are of immense extent, and are to be found principally in Staffordshire, Shropshire, South Wales, Yorkshire, Derbyshire, North Wales, Durham, and some parts of Scotland. Copper is most abundantly produced in Cornwall and Devonshire; but certain quantities are also furnished from Anglesey, some parts of Ireland, and some from Staffordshire. Lead mines are abundant, and very productive on the borders of Northumberland, Cumberland, and Durham; next in value may now be placed those of Flintshire and Denbighshire. The lead-mines of Derbyshire were formerly very important, but are now much declined in value. Yorkshire has some productive tracts; and this metal is also found in Scotland, South Wales, Devonshire, and Cornwall. Tin is a very rare product, and but few parts of the world furnish it; in England it is quite confined to Cornwall and Devonshire, and it has there been worked from the earliest times, so as very probably to have been the first article of trade of our island, as we find the Phœnicians came here to purchase it. The ores of zinc are found in Somersetshire, Wales, Cornwall, and in other places, commonly with the ores of lead. Manganese is pretty abundant in the western parts of Devonshire and the adjacent parts of Cornwall. The quantity of silver raised in this country is certainly not very great; yet it is common in many of our lead ores, and is extracted in Cornwall, Northumberland, and Devonshire. It often exists, however, in a proportion that does not pay for separating it from the lead. The true silver ores are not common with us: however, they have been found in some instances, which are confined to Cornwall. The Herland mine, which was some time since worked, yielded some quantity; and in the eastern part of the county some regular silver veins are now working that produce ores similar to those of Peru or Mexico. Gold has been found in small quantities in Ireland, Cornwall, Scotland, and Devonshire; and arsenic, antimony, cobalt, and some other inferior metals, are found in the mines of Cornwall.

The other countries in the old world, which deserve notice for the metals they afford, are Germany, particularly Saxony and the Hartz Mountains, which have for many ages been the seat of mining, and have produced silver, lead, and a variety of other metals; Hungary which is rich in gold. Sweden and Finland have been long celebrated, and particularly for iron and copper mines, which formerly supplied a great part of the world, but now have much failed in their richness. The quality, however, of the Swedish iron and copper is still unrivalled. Siberia has been productive mines of the same metals. The rivers of Africa have long been known for the gold found in their sands, and many parts of Asia have yielded the precious metals as well as others. Spain was celebrated for its mines, and particularly of quicksilver or mercury and lead; and France has endeavoured to force its mines into notice, though almost too inconsiderable to deserve it In later times the great source of the precious metals has been the southern parts of America, and most of the enterprise of the adventurers to the new world may be attributed to the abundance of them which was soon found to exist there; and, from the time that Europeans gained footing, the quantity of gold from the Brasils, and of silver from Mexico and Peru, has been immense.

Experience has taught us, as has been observed, that metals are only to be found in sufficient quantity to repay the labor of procuring them in certain rocks, which are therefore called metalliferous. With respect to the general position of these rocks, as relating to each other and to those of a different order, it will be only necessary to state that the most important are, primitive rocks: granite, gneiss, mica, slate, clay slate. Secondary rocks: gritstone or sandstone, limestone, shale or plate.

Geologists indeed enumerate many others, but miners consider them as modifications of the same.

In this country clay slate is the most productive of the primitive class, and limestone of the secondary. The metallic ores are found occupying certain spaces in these rocks, which have been arranged under the names of veins, beds, and masses. The two first are the most usual.

Mineral veins are to be understood as fissures, which have been filled up by different mineral substances. Professor Brande very justly remarks that the term vein is objectionable, as it conveys the idea of a tube or pipe filled with metal; whereas it is a plate or lamina. They extend in nearly right lines, are of unequal thickness, penetrate to unknown depths, and usually are somewhat inclined from the perpendicular. They contain a great variety of metals differing in different countries, and in distinct veins in the same country.

English miners have different terms for veins: in Cornwall they are called lodes, in Derbyshire rakes, and the term dyke, sometimes used, describes the same thing. In these deposits the ores are accompanied by earthy substances generally in a a crystallised or sparry form, called vein-stones, matrix, gangue. Beds are the other kind of regular depository of metallic ores. These are flat or tabular masses interposed between strata of rock, and thus resemble beds of coal. They are seldom very thick; and mostly produce iron, manganese, and sometimes lead. Masses, or as they are sometimes called pipes, are irregular deposits of the metals, and, not being usual, need not occupy much of our notice. The metals or their ores are also sometimes found in alluvial soil, such as gravel and sand, in valleys, and particularly gold in a native form in many places, and tin ore in Cornwall and Banca. See MINERALOGY.

We may conjecture that the first rude process, by which metals were extracted from the ores, was that of putting a quantity of ore upon a

heap of wood, and setting the pile on fire, in conformity to the manner in which ores were smelted during the burning of forests; but as the force of the fire is greatly diminished by the dispersion of its flame, and as the air acts more forcibly in exciting fire when it rushes upon it with greater velocity, it is likely that the heap of wood and ore would soon be surrounded with a wall of stone, in which sufficient openings would be left for the entrance of the air, and thus a kind of furnace would be constructed.

The Peruvians, we are told, had discovered the art of smelting and refining silver, either by the simple application of fire, or, where the ore was more stubborn and impregnated with foreign substances, by placing it in small ovens or furnaces on high grounds, so artificially constructed, that the draught of air performed the function of a bellows, a machine with which they were totally unacquainted. This method of smelting ores on high grounds, without the assistance of a bellows, or at least of bellows moved by water, seems to have been formerly practised in other countries as well as in Peru. There are several places in Derbyshire, called boles by the inhabitants, where lead has been anciently smelted, before the invention of moving bellows by water; these boles were always situated upon high grounds, and mostly upon that side of a hill which faces the west, probably because the wind proceeds most frequently from that quarter. From a pig of lead, dug up in 1766 at one of these boles, near Matlock, and bearing an inscription in relievo, from which it appears to have been smelted in the age of Adrian, many of the boles in Derbyshire seem to be of high antiquity. However, this method of smelting ore by the variable action of the wind, being a very troublesome and precarious process, has been universally disused, and the more regular blast of a bellows has been introduced in its stead.

As the metals are generally intimately mixed and blended with earthy matter or spar, or often with other metallic matter of inferior value, before the processes of smelting or reduction by fire are resorted to, various mechanical operations are used to free them from such admixtures as much as possible, so that they may be rendered as pure as these means will allow before they go to the furnace.

The following is a brief account of the processes of *dressing*:—The ores, when first raised from the mines, are in various states; some in large masses from other matter, other large masses containing ores, spars, &c.; small pieces both of pure ore and that which is mixed, and much that is crumbled to small minute fragments.

The first operations relate to separating them into proper sizes and qualities by spulling or knocking, sifting or gridling, and picking. The purer parts are then separated, and are often removed at once for smelting after having been broken down to a certain degree of fineness or size. The other or mixed parts are submitted to various processes of washing, but first must be put into a proper state of division by being bruised and sifted to uniform sizes: this is done either by cobbing and bucking, manual operations; or by crushing and stamping by machines.

The processes of *washing* are very various, but depend on one general principle, that the metallic may be separated from the earthy parts by their different specific gravities. Thus, if both are agitated together in water, the heaviest will sink or be deposited first. This principle is applied by throwing the ores into streams of water, running over planes gently inclined. The ores settle at the upper, and the spar and earthy parts at the lower.

Another way much in use is by agitating the whole in sieves, so fine as to permit but little of the solid matter to pass, but to admit the water freely. By this agitation in water, the ore settles to the bottom of the sieve, and the spar or matrix floats at the top, where it is skimmed off and thrown away, and this is called jegging. When the ores are cleaned by dressing, they are fitted for the operations of reduction or smelting.

The following simple method of *smelting* is practised by the natives of the province of Mekran in Persia; which, although it may at times leave a trifling portion of the earth mixed with the metal, is, from its ingenuity, worthy of notice. When a sufficient quantity of the ore is collected, it is placed upon a pile of wood, which is set on fire, and constantly replenished with fresh fuel, until the ore melts and falls to the bottom, when it is separated from the ashes, and found to be considerably clearer than when first taken from the mine. It is then placed in a pit, made of earthern tiles, so constructed as to admit a fire under it. The ore is again melted in this pit, and a considerable quantity of the dirt and dross removed, by skimming the surface. After this process the metal is lifted out in a liquid state, poured into hollow cylinders of clay, and then sold.

To come to a complete understanding, relative to the processes of smelting, we must bear in mind the compound nature of these substances; observing, first, that all the ores are much mixed with earthy matter, even after the operation of dressing or washing, so that these earthy parts often bear a large proportion to the whole. Secondly, that volatile mineralisers, or substances which may be dissipated or evaporated by heat alone, enter in most cases into the composition of the ores. These, as has been mentioned, are sulphur, arsenic, carbonic acid, as the most common, and having therefore considerable influence on the processes. Thirdly, that other substances are found combined with the metals which cannot be evaporated simply, but may be separated by the addition of other bodies, to which they have greater chemical affinity. These are first and principally oxygen, and occasionally some acids. Lastly, that the metals being obtained, when the foregoing admixtures are got rid of, in a state of union one with the other, or at least to a certain extent, it must follow that, to have the one which we want in a pure state, the other should be separated or destroyed.

The processes which are employed for all these objects are, calcination or roasting; fusion or melting; refining, which is performed in se

veral modes. All these operations require the application of heat; and in most of them it is urged to a great degree of intensity.

The furnaces employed are of two classes. Blast furnaces, where the fire is excited by the use of bellows, or air cylinders constantly working; and air furnaces, where the effect is produced by strong draught, occasioned by the height or construction of the stacks of chimneys.

Blast furnaces are almost entirely employed in the reduction of the ores of iron, and are for that purpose constructed of large dimensions. Of a smaller size they are very commonly used in iron foundries, where pig-iron is simply melted for making various articles of cast-iron; and similar furnaces are in use in what are called the blowing-houses in Cornwall, for the finer kind of tin, called grain-tin. Blast furnaces of a small kind, called hearths, are much employed also in Cumberland and Yorkshire for melting lead ore; but they are nearly confined to this district, as the Derbyshire and Welsh smelters prefer air furnaces. The fuel mostly in use for the blast furnaces is coke, or coal charred so as to drive off its bituminous part; this is common for iron. In lead ores the principal fuel is peat or turf, with a small mixture of coal. And for tin ores they employ wood charcoal; coal would not answer, as it would cake together, and prevent the proper action of the furnace.

Air furnaces for smelting are of a construction which is usually called a reverberatory, though they have also some other local appellations. It is not unlike a large flat oven with the fire-place at one end, and the chimney at the other; so that the matter to be acted upon being placed in the bottom, between the flame playing over it, and reverberating upon it, produces the effect desired. These furnaces are used with a gentle draught and a moderate red heat for calcining or roasting, and with a stronger draught and an intense heat for fusion or flowing, and also for refining. They are the furnaces for copper ores, for lead ores in many places, and for the greater part of the tin ores. Common coal is the fuel used in them, and is the best adapted for them, as the strong flame it gives is just what is required, and the fire-places are so constructed that the fire can be stirred and supplied at pleasure.

The first operation which we shall notice, as it is the first in order in the large way, is that of *calcination* or *roasting*. The object here is to evaporate the volatile substances, or such as may be driven off by heat, or converted into a gaseous or aëriform state. These are most commonly sulphur or arsenic, and occasionally some acids.

In the roasting of ores, the following attentions must be given:—1. To reduce the mineral previously into small lumps, that the surface may be increased; but they must not be so small, nor placed so compactly, as to prevent the passage of the air and flame. 2. The larger pieces must be placed at the bottom of the pile, where the greatest heat is. 3. The heat must be gradually applied, that the sulphur may not be melted, which would greatly retard its expulsion; and that the spars, fluors, and stones, intermixed with the ore, may not crack, fly, and be dispersed. 4. The ores not thoroughly roasted by one operation must be exposed to a second. 5. The fire may be increased towards the end, that the noxious matters more strongly adhering may be expelled. 6. Fuel which yields much flame, as wood and fossil coals free from sulphur, is said to be preferable to charcoal or cokes. Sometimes cold water is thrown on the calcined ore, at the end of the operation, while the ore is yet hot, to render it more friable. No general rule can be given concerning the duration or degree of the fire, these being very various according to the difference of the ores. A roasting during a few hours or days is sufficient for many ores; while some, such as the ore of Rammelsberg, require that it should be continued during several months.

Schlutter enumerates five methods of roasting ores. 1. By constructing a pile of ores and fuel placed in alternate strata, in the open air, without any furnace. 2. By confining such a pile within walls, but without a roof. 3. By placing the pile under a roof, without lateral walls. 4. By placing the pile in a furnace consisting of walls and a roof. 5. By roasting the ore in a reverberatory furnace, in which it must be continually stirred with an iron rod.

The German process for extracting sulphur from pyrites may be thus described:—It ought, in the first instance, to be exposed to a heat sufficient to sublime the sulphur, or to make it distil in vessels, which must be close to prevent its burning. The furnaces employed for this operation are oblong, like vaulted galleries; and in the vaulted roofs are made several openings. These are called furnaces for extracting sulphur. In these furnaces are placed earthenware tubes, filled with pyrites broken into pieces of the size of small nuts. Each of these tubes contains about fifty pounds of pyrites. They are placed in the furnace almost horizontally, and have scarcely more than an inch of descent. The ends, which come out of the furnace five or six inches, become gradually narrower. Within each tube is fixed a piece of baked earth in form of a star, at the place where it begins to come narrower, in order to prevent the pyrites from falling out, or choking the mouth of the tube. To each tube is fitted a receiver, covered with a leaden pipe, pierced with a small hole to give air to the sulphur. The other end of the tube is exactly closed. A moderate fire is made with wood, and in eight hours the sulphur of the pyrites is found to have passed into the receivers. The residuum of the pyrites, after distillation, is drawn out at the large end, and fresh pyrites is put in its place. From this residuum, which is called burnings of sulphur, vitriol is extracted.

The eleven tubes, into which were put, at three several distillations, in all 900lbs. of pyrites, yield from 100lbs. to 150lbs. of crude sulphur, which is so impure as to require to be purified by a second distillation. This purification of crude sulphur is also done in a furnace in form of a gallery, in which five cucurbits are arranged on each side. These cucurbits are placed in a sloping direction, and contain about eight quintals and a half of crude sulphur. To them are

luted earthen tubes, so disposed as to answer the purpose of capitals. The nose of each of these tubes is inserted into an earthen pot, called the forerunner. This pot has three openings; namely, that which receives the nose of the tube; a second smaller hole, which is left open to give air; and a third in its lower part, which is stopped with a wooden peg.

When the preparations are made, a fire is lighted, about seven o'clock in the evening, and is a little abated when the sulphur begins to distil. At three o'clock in the morning the wooden pegs, which stop the lower holes of the forerunners, are for the first time drawn out, and the sulphur flows out of each of them into an earthen pot with two handles, placed below for its reception. In this distillation the fire must be moderately and prudently conducted; otherwise less sulphur will be obtained, and it would also be of a gray color, and not of the fine yellow which it ought to have when pure. The ordinary loss in the purification of eight quintals of crude sulphur is, at most, one quintal.

When all the sulphur has flowed out, and has cooled a little in the earthen pots, it is cast into moulds made of beech-tree, which have been previously dipped in water, and set to drain. As soon as the sulphur is cooled in the moulds, they are opened, and the cylinders of sulphur are taken out and put up in casks. These are called roll-brimstone.

There are some ores which contain so much sulphur that part of it is actually collected in the ordinary operation of roasting, without much trouble for that purpose. Such is the ore of Ramelsberg, in the country of Hartz. This ore, which is of lead, containing silver, is partly very pure, and partly mixed with cupreous pyrites and silver; hence it is necessary to roast it. The roasting is performed by laying alternate strata of ore and wood upon each other in an open field, taking care to diminish the size of the strata as they rise higher; so that the whole mass shall be a quadrangular pyramid truncated above, whose base is about thirty-one feet square. Below, some passages are left open, to give free entrance to the air; and the sides and top of the pyramid are covered over with small ore, to concentrate the heat and make it last longer. In the centre of this pyramid there is a channel which descends vertically from the top to the base. When all is properly arranged, ladles full of red-hot scoria, from the smelting furnace are thrown down the channel, by which means the shrubs and wood placed below for that purpose are kindled, and the fire is from them communicated to all the wood of the pile, which continues burning till the third day. At that time the sulphur of the mineral becomes capable of burning spontaneously, and of continuing the fire after the wood is consumed.

When this roasting has been continued fifteen days the mineral becomes greasy; that is, it is covered over with a kind of varnish; twenty or twenty-five holes or hollows are then made in the upper part of the pile, in which the sulphur is collected. From these cavities the sulphur is taken out thrice every day, and thrown into water. This sulphur is not pure, but crude; and is therefore sent to the manufacturers of sulphur to be purified in the manner above related.

The calcination of copper, lead, and tin ores, is performed in reverberatory furnaces at a moderate red heat. In the copper works in South Wales, each furnace contains full three tons of raw ores, which are frequently burned, to expose fresh surfaces, for twelve hours. Lead ores are treated in the same manner, in the same furnace often, which, with a higher heat, is used to melt them, and the charge seldom exceeds a ton. Tin ores being simple oxides, and not decomposable in this way, are roasted or calcined principally to alter the specific gravity of the pyrites with which they are mixed, which thus may be separated by subsequent dressing or washing. The furnaces for this purpose, in Cornwall, are called burning-houses. Iron ores, though commonly oxides, are often mixed with sulphurets or iron pyrites, and are roasted to free them from the sulphur; this, however, is not done in furnaces, but the ore is stratified with refuse coal, and burnt in large heaps in the open air.

At the Paris and Mona copper mines in the island of Anglesey, where the ores are poor in metal, but contain a large proportion of sulphur, they are treated in the same way, except that they do not find it necessary to use coal, as a small quantity of wood is sufficient to set the ore on fire, and combustion goes slowly on, owing to the sulphur; a heap of 300 or 400 tons is eight months in burning, and some of the sulphur is sublimed and is condensed in chambers or vaults, to which the flues are conducted.

In the process of calcination sulphur is generally inflamed, and, uniting with the oxygen of the atmosphere, is converted into sulphurous acid gas; which mixed, as it is, with the vapor of certain volatile metals, such as arsenic, zinc, antimony, or lead, forms a dense or suffocating smoke destructive of vegetation; but it does not appear so prejudicial to animal life, except where lead is prevalent. Whoever has seen the country round the copper works at Swansea, will have observed the desolating effect of the smoke; and yet it is proved, on the best evidence, that the men are not subject to any peculiar disease. One set of works there, belonging to Messrs. Vivians, who purchase the ores from the mines in Cornwall, sometimes work at the rate of 600 tons per week. These gentlemen have some time back constructed, at a great expense, erections to condense the noxious vapors, and upon which they have consulted Mr. Philips and other eminent chemists. They have altogether eighty-four reverberatory furnaces, of which twenty-five are used for calcining.

The ores being deprived of sulphur, or at least to a certain degree (for one calcination does not effect this completely), the next step in smelting is to get rid of all the earthy matter, which is done at once by the simple operation of bringing the whole into a state of *fusion*. It has already been stated that some of the metallic oxides combine with certain earths in fusion, and act powerfully as a flux, which is a term employed for substances that promote the fusibility of others in the fire. It is also necessary to remark, that although a single earth, as silex, for instance, is nearly in-

fusible by itself in our strongest fires; yet, by mixing the earths together, their infusibility is increased, and we obtain the power of rendering them all fluid by heat. Further, that some of the earths and some of the metallic oxides possess this influence in a greater degree than others. Thus lime, in all its states, but particularly in that of fluor-spar, and oxide of lead, are the most powerful assistants of the fusion of earthy matter in general, or the best fluxes. Many salts, indeed, possess this property to a much greater extent; but they are far too expensive for use in the larger operations of smelting, though they are much used for trials in the small way, called assays.

Now as the ores commonly contain different mixtures in different mines, and as it results from what has been said that such a combination as may be thus expected is useful in promoting the fusion of the whole, the smelters find it desirable to mix the ores from different veins on this account; but, as even this does not always succeed sufficiently, an addition is commonly made of lime, limestone, or fluor-spar. With a mixture of these the ores are submitted to the strongest action of the fire; complete fusion of the whole mass takes place; the earthy parts form a fluid impure glass, being completely vitrified; the metallic parts of the ore, either quite free from sulphur, or in a degree combined with it, are also entirely melted, and a perfect separation takes place; owing to the great difference in the specific gravity of the substances: the earthy glass in a liquid state, which is now called slag or scoria, occupying the upper place, and the metallic part by its weight sinking down and forming a liquid stratum of melted metal underneath, where also it is prevented from oxidation and evaporation from the intense heat applied. The whole is in some cases stirred, to assist the precipitation of the metallic matter to the bottom of the furnace; in other cases this is left to take place of itself.

The fusion of copper ore is conducted in reverberatory furnaces at a high degree of heat, and the slag is raked off in a fluid state. Lead and tin ores are treated in a nearly similar manner.

Iron smelting is carried on in blast furnaces of very large dimensions. in which coke is employed as fuel, and limestone is used as a flux. Copper of the first flowing is in part combined with sulphur, so as to require subsequent calcinations and repeated fusions before it comes to the refining process. Lead is generally produced pure in one operation from the reverberatory furnace, and also from the blast-furnace, where the sulphur is dissipated partly by the application of heat, and partly by combining with the lime which is used. Tin, being produced from an oxide, some carbonaceous matter, such as small-coal, is used in mixture with the ores, the carbon unites with the oxygen and leaves the metal pure, except as it may happen to be mixed with other metallic substances.

By the operations which have been described the whole metallic contents of the ores are produced in a separate state, the volatile part being dissipated by calcination, and the earthy part by being converted into slag, which is easily detached from the metal. It is evident, however, that if more metals than one exist in the ores they will all be reduced by the same treatment, and therefore we may, and often do, procure an alloy more or less complicated.

The *purification* of the metals is performed by various processes of refining, which are suited to their several qualities, and advantage is taken of the different properties in each to effect this. Thus, some metals are refined by their having less affinity for oxygen than others; such as gold, silver, and copper; these, not being easily oxidised in the fire, may be exposed to a strong and continued heat, which converting the inferior metals into oxides, they rise to the surface of the melted mass, from which they may be removed by various means. An example of this is the separation of lead from silver. This operation is called testing or cupellation. Another mode of refining is, when one metal is more fusible than another, whereby a separation of the two may effected. Thus tin of the first melting often contains some iron or copper, but, being melted at a very low red heat, the tin oxides, leaving the others, which do not flow but at a higher temperature. Silver is separated from copper when it is in small proportions, by adding lead to the whole infusion. The silver unites with the lead, and is separated with it afterwards by a heat which melts it out from the copper. This process is called eliquation. The silver is separated from the lead afterwards by cupellation, which is a process adapted also to procuring gold.

Where metals in the state of oxide are to be reduced into their malleable or proper form, it is done by fusion, in contact with carbon, as was described in the case of tin ores; and they are therefore mixed with small-coal, wood, or charcoal. The oxygen leaves the metal, and forms, with the carbon, carbonic acid, which escapes. Thus litharge, which is the oxide of lead obtained by cupellation, is again brought into the state of lead: this process is called reviving. Iron, in its perfect state, is nearly infusible, and it must be largely combined with carbon to make it melt freely; on which account we see the use of smelting the ores in contact with coke. The carbon is separated when it is converted into bar-iron; and, in converting this into steel, carbon is again made to combine in another proportion. Copper requires, after it is freed as much as possible from the other metals, a peculiar treatment with charcoal, and a continued melting heat; which process is called toughening. The melted metal is much stirred with wood poles, and after a time assumes the required properties of extending under the hammer without being subject to crack. The theory of this process is rather obscure. The volatile metals would of course be dissipated if they were exposed to the heat requisite for melting them out from the substances with which they are mixed in their ores in open furnaces; they are therefore distilled in retorts, which are generally made of iron. Distillation is employed in this country for obtaining zinc, and abroad also for this metal and in the mines of mercury.

The mode of extracting the precious metals most in use in Hungary and other parts of Ger-

many, as well as in all the American mines, is that of amalgamation of the ores with mercury. By this process the gold or silver is dissolved by the mercury and separated from the earthy mixture, and also from baser metals, which do not so readily combine with mercury. This process requires, however, that the ores should be previously calcined to decompose the sulphurets, and an addition of common salt is added to facilitate this decomposition; the whole is then finely powdered and triturated in water with the mercury by machines. Subsequent distillation separates and preserves the mercury, and the gold or silver is refined in the usual way.

The metals raised in this country form an important part of our national wealth: they are exported in considerable quantities in their unmanufactured state; but a greater proportion are worked up into innumerable forms, and thus contribute much more largely to the general stock, in the employment and encouragement of industry and ingenuity. The most important metals produced in Great Britain are, iron, copper, lead, tin. With respect to the first, the iron-works of this country, as is well known, are of immense extent, and are rapidly increasing in produce. By improved methods of manufacture iron has, of late years, been much reduced in price, and this has increased the demand both at home and abroad. The manufacture of iron may be computed at

Wales	150,000	tons.
Shropshire and Staffordshire	180,000	
Yorkshire and Derbyshire	50,000	
Scotland and other places	20,000	
	400,000	
	£5	per ton.
	£2,000,000	

The quantity of copper raised is about 10,000 tons; of which about 8000 tons are produced in Cornwall, and the remainder in Anglesey, Devon, Ireland, and Staffordshire. In the year 1800 the quantity of copper raised in the Cornish mines was between 5000 and 6000 tons; so that there has been an increase since that time of from 2000 to 3000 tons. The value of the whole quantity of copper in its unmanufactured state is about £1,000,000.

The lead of Great Britain probably amounts to from 30,000 to 32,000 tons. The northern parts of the kingdom, Cumberland, Durham, and Northumberland, produce 12,000 tons.

North Wales and Shropshire	8,000
Yorkshire	4,500
Derbyshire	4,000
Scotland, Devon, Cornwall, and South Wales . . .	3,000
	31,500

The value of the lead is altogether about £750,000.

Tin, as before stated, is only found in Cornwall and Devon, and the quantity has fluctuated from 2800 to 5000 tons in the year: of late we may reckon it at somewhat above 3000 tons, and its value about £400,000. We have also certain quantities of zinc, manganese, silver, antimony, and cobalt; but of these it is difficult to estimate the quantity or value.

The aggregate value of the metals of the kingdom is thus more than £4,000,000, but is increased enormously when manufactured; and they are the foundation of important branches of our commerce in our unrivalled fabrication of hardware.

Iron is exported to almost all parts of the world in its raw, as well as in its manufactured states, and in an infinite diversity of useful and ornamental forms which it would be tedious to attempt to describe.

Copper is employed largely in its simple state, particularly rolled into sheet; and is also very much used in mixture with other metals, it being the principal constituent in brass, gun-metal, and pot-metal. The town of Birmingham alone is said to require 2000 tons a year for its varied manufactures. About 3000 tons have of late been annually sent to the East Indies and America, United States; the West Indies and different countries in Europe take from us considerable supplies.

Of the large portion of lead which our mines produce a considerable part is worked up into forms which at once destroy it, so that it does not return again for use. Thus 5000 tons a year are made into small shot, partly for home consumption and partly for exportation. The quantity made into white and red-lead and principally used as pigments, and part converted into the glazing of pottery, or an ingredient of glass-making, is little, if at all, short of 10,000 tons.

Tin is an article of export to most countries; a great deal is often sent to China; and, in the manufacture of tin plate, or thin rolled iron coated with tin in the manner before described, is a large article of commerce.

Swedenborgius has very industriously and exactly described the different processes used in most parts of Europe, for the smelting of ores of iron, for the forging of that metal, and for the conversion of it into steel; but we do not find that he, or any other author, have, by experiments and discoveries, contributed much to the illustration or to the improvement of this part of metallurgy; unless, perhaps, we except those of M. Reaumur, concerning the softening of cast-iron by cementation with earthy substances. The ores of iron are known to vary much in their appearance, in their contents, in their degrees of fusibility, in the methods necessary for the extraction of their contained metal, and in the qualities of the metal when extracted.

Most ores require to be roasted previously to their fusion; some more slightly, and others with a more violent and long-continued fire. Those which contain much sulphur, arsenic, or vitriolic acid, require a long-continued and repeated roasting, that the volatile matters may be expelled. Of this kind is the black iron ore, from which the Swedish iron is said to be obtained. Some ores require a very slight roasting only, that they may be dried and rendered friable. Such are the ores called bog ores, and others which being in a calcined state, and containing little sulphureous matter, would, by a farther

calcination, be rendered less capable of being reduced to a metallic state.

The roasting of ores of iron is performed by kindling piles, consisting of strata of fuel and of ore placed alternately upon one another, or in furnaces similar to those commonly employed for the calcination of lime-stone. Some authors advise the addition of a calcareous earth to sulphureous ores during the roasting, that the sulphur may be absorbed by this earth when converted into quicklime. But we may observe, that the quicklime cannot absorb the sulphur or sulphureous acid, till these be first extricated from the ore, and does therefore only prevent the dissipation of these volatile matters; and, secondly, that the sulphur thus united with the quicklime forms a hepar of sulphur, which will unite with and dissolve the ore during its fusion, and prevent the precipitation of the metal.

The next operation is the fusion or smelting of the ore. This is generally performed in furnaces, or towers, from twenty to thirty feet high; in the bottom of which is a basin for the reception of the fluid metal. When the furnace is sufficiently heated, which must be done at first very gradually, to prevent the cracking of the walls; a quantity of the ore is to be thrown in from time to time, at the top of the furnace, along with a certain quantity of fuel and limestone, or whatever other flux is employed. When the fuel below is consumed by the fire, excited by the wind of the bellows, the ore, together with its proportional quantity of fuel and of flux, sink gradually down, till they are exposed to the greatest heat in the furnace. There the ore and the flux are fused, the metallic particles are revived by the fuel, are precipitated by means of their weight through the scoria formed of the lighter earthy parts of the flux and of the ore, and unite in the basin at the bottom of the furnace, forming a mass of fluid metal covered by a glassy scoria. When a sufficient quantity of this fluid metal is collected, which is generally twice or thrice in twenty-four hours, an aperture is made, through which the metal flows into a channel or groove made in a bed of sand; and from thence into smaller, lateral, or connected channels, or other moulds. There it is cooled, becomes solid, and retains the forms of the channels or moulds into which it flows. The piece of iron formed in the large channel is called a sow, and those formed in the smaller channels are called pigs. Sometimes the fluid iron is taken out of the furnace by means of ladles, and poured into moulds ready prepared, of sand or of clay, and is thus formed into the various utensils and instruments for which cast iron is a proper material.

The scoria must be, from time to time, allowed to flow out, when a considerable quantity is formed, through an aperture made in the front of the furnace for that purpose. A sufficient quantity of it must, however, be always left to cover the surface of the melted iron, else the ore which would fall upon it, before the separation of its metallic from its unmetallic parts, would lessen the fluidity and injure the purity of the melted metal. This scoria ought to have a certain degree of fluidity; for, if it be too thick, the revived metallic particles will not be able to overcome its tenacity, and collect together into drops, nor be precipitated. Accordingly, a scoria, not sufficiently fluid, is always found to contain much of the metal. If the scoria be too thin, the metallic particles of the ore will be precipitated before they are sufficiently metallised, and separated from the earthy and unmetallic parts. A due degree of fluidity is given to the scoria by applying a proper heat and by adding fluxes suited to the ore.

Various substances are added to assist the fusion of iron ores which are difficultly fusible. These are, 1. Ores of a fusible quality, or which, being mixed with others of a different quality, become fusible: accordingly, in the great works for smelting ores of iron, two or more different kinds of ore are commonly mixed, to facilitate the fusion, and also to ameliorate the quality of the iron. Thus an ore yielding an iron which is brittle when hot, which quality is called red-short, and another ore which produces iron brittle when cold, or cold-short, are often mixed together; not, as sometimes supposed, that these qualities are mutually destructive of each other, but that each of them is diminished in the mixed mass of iron, as much as this mass is larger than the part of the mass originally possessed of that quality. Thus, if from two such ores the mass of iron obtained consists of equal parts of cold-short and of red-short iron, it will have both these qualities, but will only be half as cold-short as iron obtained solely from one of these ores, and half as red-short as iron obtained only from the other ore. 2. Earths and stones are also generally added to facilitate the fusion of iron ores. These are such as are fusible, or become fusible when mixed with the ore, or with the earth adhering to it. Authors direct that, if this earth be of an argillaceous nature, limestone or some calcareous earth should be added; and that, if the adherent earth be calcareous, an argillaceous or siliceous earth should be added; because these two earths, though singly infusible, yet, when mixed, mutually promote the fusion of each other; but as limestone is almost always added in the smelting of iron ores, and as in some of these, at least, no argillaceous earth appears to be contained, we are inclined to believe, that it generally facilitates the fusion, not merely by uniting with those earths, but uniting with that part of the ore which is most perfectly calcined, and least disposed to metallisation; since we know that by mixing a calciform or roasted ore of iron with calcareous earth, without any inflammable matter, these two substances may be totally vitrified. Calcareous earth does indeed so powerfully facilitate the fusion of iron ores, that it deserves to be considered whether workmen do not generally use too great a quantity of it in order to hasten the operation. For, when the scoria is rendered too thin, much earthy or unmetallised matter is precipitated, and the cast iron produced is of too vitreous a quality, and not sufficiently approximated to its true metallic state.

Some authors pretend that a principal use of the addition of limestone in the smelting of iron ores is to absorb the sulphur, or vitriolic acid, of these ores: but, as we have already observed, a hepar of sulphur is formed by that mixture of

calcareous earth and sulphur, which is capable of dissolving iron in a metallic state; and thus the quantity of metal obtained from an ore not sufficiently divested of its sulphur, or vitriolic acid (which, by uniting with the fuel, is formed into a sulphur during the smelting), must be considerably diminished, though rendered purer, by the addition of calcareous earth: hence the utility appears of previously expelling the sulphur and vitriolic acid from the ore by a sufficient roasting. 3. The scoria of former smeltings is frequently added to assist the fusion of the ore; and, when the scoria contains much iron, as sometimes happens in ill-conducted operations, it also increases the quantity of metal obtained.

The quantity of these fusible matters to be added varies according to the nature of the ore; but ought in general to be such, that the scoria shall have its requisite degree of thinness, as above mentioned.

The *fuel* used in most parts of Europe for the smelting of ores of iron is charcoal. In several works, in England and Wales, iron ore is smelted by means of pit-coal previously reduced to cinders, or cokes, by a kind of calcination similar to the operation for converting wood into charcoal, by which the aqueous and sulphureous parts of the coal are expelled, while only the more fixed bituminous parts are left behind. The quality of the iron depends considerably upon the quality and also upon the quantity of the fuel employed. Charcoal is fitter than cokes for producing an iron capable of being rendered malleable by forging. The quantity of fuel, or the intensity of the heat, must be suited to the greater or less fusibility of the ore. Sulphureous, and other ores easily fusible, require less fuel than ores distinctly fusible. In general, if the quantity of fuel be too small, and the heat not sufficiently intense, all the iron will not be reduced, and much of it will remain in the scoria, which will not be sufficiently thin. This defect of fuel may be known by the blackness and compactness of the scoria; by the qualities of the iron obtained, which, in this case, is hard, white, light, intermixed with scoria, smooth in its texture, without scales or grains, rough and convex in its surface, and liable to great loss of weight by being forged; and, lastly, it may be known by observing the color and appearance of the drops of metal falling down from the smelted ore, and of the scoria upon the surface of the fluid metal, both of which are darker colored than when more fuel is used. When the quantity of fuel is sufficiently large, and the heat is intense enough, the iron is darker colored, denser, more tenacious, contains less scoria, and is therefore less fusible, and loses less of its weight by being forged. Its surface is also smoother and somewhat concave; and its texture is generally granulated. The scoria, in this case, is of a lighter color and less dense. The drops falling down from the smelted ore, and the liquid scoria, in the furnace, appear hotter and of a brighter color. When the quantity of fuel is too great, and the heat too intense, the iron will appear to have a still darker color, and more conspicuous grains or plates, and the scoria will be lighter, whiter, and more spongy. The drops falling from this melted ore, and the fluid scoria, will appear to a person looking into the furnace through the blast-hole to be very white and shining hot. The quantity of charcoal necessary to produce 5 cwt. of iron, when the ore is rich, the furnace well-contrived, and the operation skilfully conducted, is computed to be about forty cubic feet; but is much more in contrary circumstances.

The time during which the fluid metal ought to be kept in fusion before it is allowed to flow out of the furnace must also be attended to. How long that time is, and whether it ought not to vary according to the qualities of ores and other circumstances, we cannot determine. In some works the metal is allowed to flow out of the furnace every six or eight, and in others only every ten or twelve hours. Some workmen imagine that a considerable time is necessary for the concoction of the metal. This is certain, that the iron undergoes some change by being kept in a fluid state; and that, if its fusion be prolonged much beyond the usual time, it is rendered less fluid, and also its cohesion, when it becomes cold, is thereby greatly diminished. The marquis de Courtivron says that the cohesion may be restored to iron in this state by adding to it some vitrifiable earth, which he considers as one of the constituent parts of iron, and which he thinks is destroyed by the fusion too long continued. That the fusibility of cast iron does depend on an admixture of some vitrifiable earth appears probable from the great quantity of scoria forced out of iron during its conversion into malleable or forged iron, and from the loss of fusibility which it suffers nearly in proportion to its loss of scoria. The quantity of iron daily obtained, from such a furnace as is above described, is from two to five tons in twenty-four hours, according to the richness and fusibility of the ore, to the construction of the furnace, to the adjustment of the due quantity of flux and of steel, and to the skill employed in conducting the operation.

The quality of the iron is judged of by observing the appearances during its flowing from the furnace, and when it is fixed and cold. If the fluid iron, while it flows, emits many and large sparkles; if many brown spots appear on it while it is yet red hot; if, when it is fixed and cold, its corners and edges are thick and rough, and its surface is spotted, it is known to have a red-short quality. If, in flowing, the iron seems covered with a thin glassy crust, and if, when cold, its texture is whitish, it is believed to be cold-short. M. Reaumur says that dark-colored cast iron is more impure than that which is white. No certain rules for judging of the quality of iron before it is forged can be given. From brittle cast-iron sometimes ductile forged iron is produced. Cast-iron with brilliant plates and points, when forged, becomes sometimes red-short and sometimes cold-short. Large shining plates, large cavities called eyes, want of sufficient density, are almost certain marks of bad iron; but whether it will be cold or red-short cannot be affirmed till it be forged. Whiteness of color, brittleness, closeness of texture, and hardness, are given to almost any cast-iron by sudden cooling; and we may observe that, in

general, the whiter the metal is, the harder it is also, whether these properties proceed from the quality of the iron or from sudden cooling; and that, therefore, the darker-colored iron is fitter for being cast into moulds, because it is capable in some measure of being filed and polished, especially after it has been exposed during several hours to a red-heat in a reverberatory furnace, and very gradually cooled. This operation, called by the workmen annealing, changes the texture of the metal, renders it softer and more capable of being filed than before, and also considerably less brittle. M. Reaumur found that, by cementing cast-iron with absorbent earths in a red heat, the metal may be rendered softer, tougher, and consequently a fit material for many utensils formerly made of forged iron.

In Navarre, and in some of the southern parts of France, iron ore is smelted in furnaces much smaller, and of a very different construction from those above described. A furnace of this kind consists of a wide-mouth copper cauldron, the inner surface of which is lined with masonry a foot thick. The mouth of this cauldron is nearly of an oval or elliptic form. The space or cavity contained by the masonry is the furnace in which the ore is smelted. The depth of this cavity is equal to two feet and a half: the larger diameter of the oval mouth of the cavity is about eight feet, and its smaller diameter is about six feet; the space of the furnace is gradually contracted towards the bottom, the greatest diameter of which does not exceed six feet: eighteen inches above the bottom is a cylindrical channel in one of the longer sides of the cauldron and masonry, through which the nozzle of the bellows passes. This channel, and also the bellows pipe, are so inclined that the wind is directed towards the lowest point of the opposite side of the furnace. Another cylindrical channel is in one of the shorter sides of the furnace, at the height of a few inches from the bottom, which is generally kept closed, and is opened occasionally to give passage to the scoria: and above this is a third channel, in the same side of the furnace, through which an iron instrument is occasionally introduced to stir the fluid metal, and to assist, as is said, the separation of the scoria from it. The greatest height of this channel is at its external aperture on the outside of the furnace, and its smaller height is at its internal aperture; so that the instrument may be directed towards the bottom of the furnace; but the second channel below it has a contrary inclination, that, when an opening is made, the scoria may flow out of the furnace into a basin placed for its reception. When the furnace is heated sufficiently the workmen begin to throw into it alternate changes of charcoal and ore previously roasted. They take care to throw the charcoal chiefly on that side at which the wind enters, and the ore at the opposite side. At the end of about four hours a mass of iron is collected at the bottom of the furnace, which is generally about 6 cwt.; the bellows are then stopped; and when the mass of iron is become solid the workmen raise it from the bottom of the furnace, and place it, while yet soft, under a large hammer, where it is forged. The iron produced in these furnaces is of the best quality; the quantity is also very considerable, in proportion to the quantity of ore, and to the quantity of fuel employed. In these furnaces no limestone or other substance is used to facilitate the fusion of the ore.

The iron thus produced by smelting ores is very far from being a pure metal; and though its fusibility renders it very useful for the formation of cannon, pots, and a great variety of utensils, yet it wants the strength, toughness, and malleability which it is capable of receiving by further operations.

Cast-iron seems to contain a large quantity of vitreous or earthy matter mixed with the pure iron; which matter is probably the chief cause of its fusibility, brittleness, hardness, and other properties by which it differs from forged iron. The sulphur, arsenic, and other impurities of the ore, which are sometimes contained in cast-iron, are probably only accidental, and may be the causes of the red-short quality, and of other properties of certain kinds of iron: but the earthy matter above mentioned seems principally to distinguish cast-iron from forged or malleable iron; for first, by depriving the former of this earthy matter, it is rendered malleable; and secondly, by fusing malleable iron with earthy and vitrifiable matters, it loses its malleability, and is restored to the state and properties of cast-iron.

The earthy vitreous matter contained in cast-iron consists probably of some of the ferruginous earth or calx of the ore not sufficiently metallised, and also of some unmetallic earth. Perhaps it is only a part of the scoria which adheres to, and is precipitated with, the metallic particles from which it is more and more separated, as the heat applied is more intense, and as the fusion is longer continued. To separate these impurities from cast-iron, and to unite the metallic parts more closely and compactly, and thus to give it the ductility and tenacity which render this metal more useful than any other, are the effects produced by the following operations:—The first of these operations is a fusion of the iron, by which much of its impurities is separated in form of scoria; and by the second operation a further and more complete separation of these impurities, and also a closer compaction of the metallic particles, are effected by the application of mechanical force or pressure by means of large hammers. Some differences in the construction of the forge or furnace, in which the fusion or refining of cast-iron is performed, in the method of conducting the operation, and in other circumstances, are observed to occur in different places.

The following new method of shingling and manufacturing iron must not be passed unnoticed. The ore, being fused in a reverberatory furnace, is conveyed, whilst fluid, into an air-furnace, where it is exposed to a strong heat till a bluish flame is observed on the surface; it is then agitated on the surface till it loses its fusibility, and is collected into lumps called loops. These loops are then put into another air-furnace, brought to a white or welding heat, and then shingled into half-blooms or slabes. They are again exposed to the air-furnace, and the half-blooms taken out and forged into anconies,

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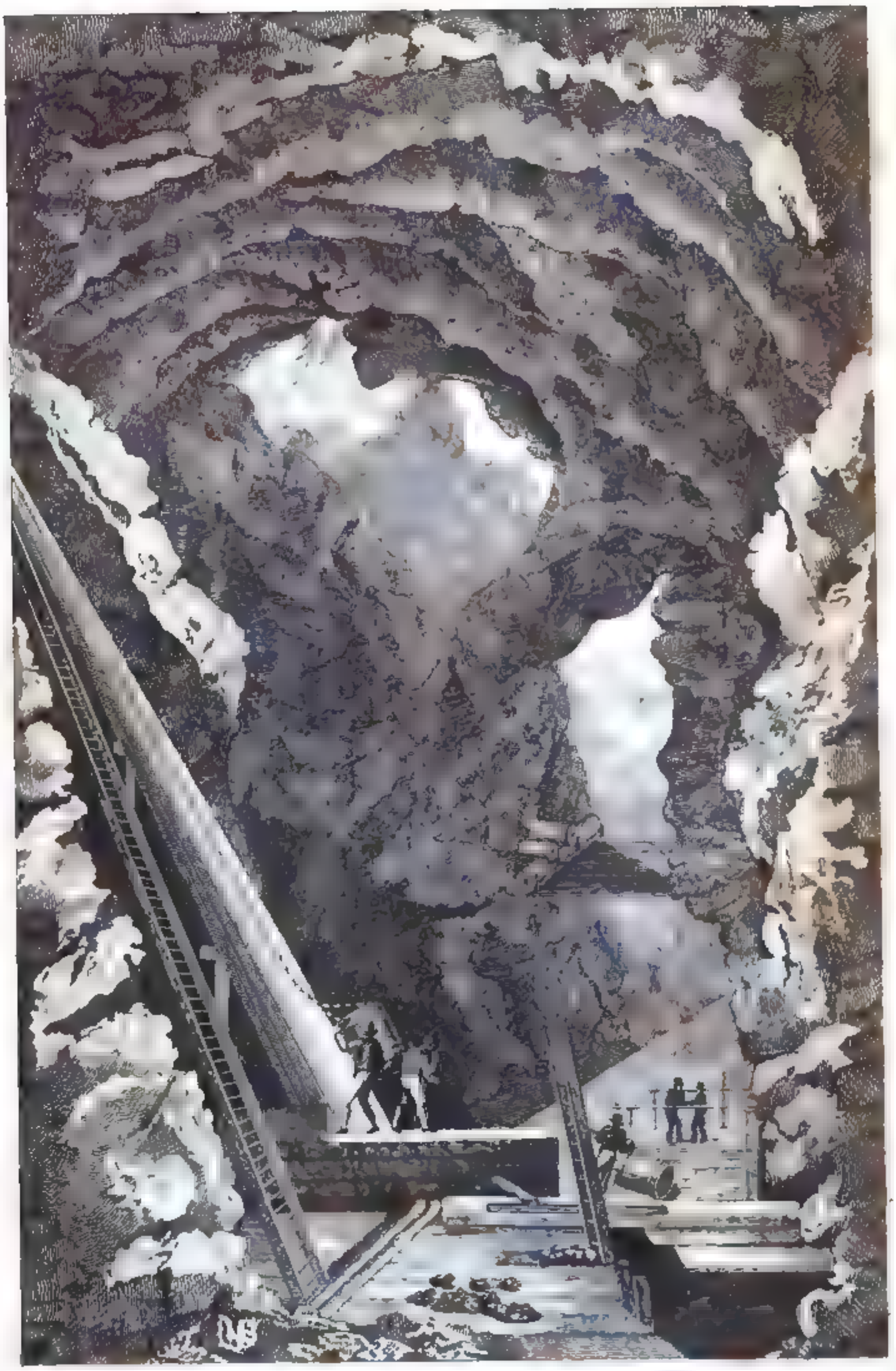
METALLURGY MINES.



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J.Shury sculp

bars, half-flats, and rods for wire; while the slabes are passed, when of a welding heat, through the grooved rollers. In this way of proceeding it matters not whether the iron is prepared from cold or red-short metal, nor is there any occasion for the use of finery, charcoal, coke, chafery, or hollow fire, or any blast by bellows, or otherwise; or the use of fluxes in any part of the process.

In one bar frequently two or more different kinds of iron may be observed, which run along its whole length; and scarcely a bar is ever found of entirely pure and homogeneous iron. This difference probably proceeds from the practice we have mentioned of mixing different kinds of ores together in the smelting; and also from the practice of mixing two or more pigs of cast-iron of different qualities in the finery of these, by which means the red-short and cold-short qualities of the different kinds are not, as we have already remarked, mutually counteracted or destroyed by each other, but each of these qualities is diminished in the mixed mass of iron, as much as this mass is larger than the part of the mass originally possessed of that quality; that is, if equal parts of red-short and of cold-short iron be mixed together, the mixed mass will be only half as red-short as the former part, and half as cold-short as the latter. For these different kinds of iron seem as if they were only capable of being interwoven and diffused through each other, but not of being intimately united or combined.

The quality of forged iron may be known by the texture which appears on breaking a bar. The best and toughest iron is that which has the most fibrous texture, and is of a clear grayish color. This fibrous appearance is given by the resistance which the particles of the iron make to their rupture. The next best iron is that whose texture consists of clear, whitish, small grains, intermixed with fibres. These two kinds are malleable both when hot and when cold, and have great tenacity. Cold-short iron is known by a texture consisting of large, shining plates, without fibres; and red-short iron is distinguished by its dark dull color, and by the transverse cracks and fissures on the surface and edges of the bars. The quality of iron may be much improved by violent compression, as by forging and rolling; especially when it is not long exposed to too violent heat, which is known to injure, and at length to destroy, its metallic properties.

A foundry of iron is, when calculated to do business on a large scale, situated near and connected with the ore and the blast furnaces, as here it is that the ore-smelting is done; and, where that is performed, castings can be executed better, and much cheaper, than when it is done at separate establishments; it is also better done, because, as more metal is heated at a time at such furnaces, there is a better chance of getting the castings perfect. It is cheaper from this very obvious circumstance, that, as the new metal is smelted, it is at once cast into the work required, instead of being run into pigs, as they are termed, to be re-heated in another furnace, and then to be founded. This additional heating, with the cost of removal and labor, is saved by founding it into what is required at its first being smelted.

Dr. Clarke's account of the iron mines he visited at Persberg, which is of a very interesting character, will be read with interest by the English metallurgist. The author's visit to these mines was made after he had personally inspected many of the principal works of the same nature in other countries, and especially in his own. For the last ten years of his life he had been much in the habit of seeing similar works: it is not therefore owing to any surprise at the novelty of the scene before him, that he has now to mention the astonishment he felt when he arrived at the mouth of one of the great Persberg mines; but he is fully prepared to say of it, and with truth, there is nothing like it in all that he has beheld elsewhere. 'For grandeur of effect, filling the mind of the spectator with a degree of wonder which amounts to awe, there is no place where human labor is exhibited under circumstances more tremendously striking. As we drew near to the wide and open abyss, a vast and sudden prospect of yawning caverns and of prodigious machinery prepared us for the descent. We approached the edge of the dreadful gulph whence the ore is raised, and ventured to look down; standing upon the verge of a sort of platform, constructed over it in such a manner as to command a view into the great opening, as far as the eye could penetrate amidst its gloomy depths: for, to the sight, it is bottomless. Immense buckets suspended by rattling chains were passing, and we could perceive ladders scaling all the inward precipices upon which the work-people, reduced by their distance to pigmies in size, were ascending and descending. Far below the utmost of these figures, a deep and gaping gulf, the mouth of the lowermost pits, was, by its darkness, rendered impervious to the view. From the spot where we stood down to the place where the buckets are filled the distance might be about seventy-five fathoms; and as soon as any of these buckets emerged from the gloomy cavity we have mentioned, or until they entered into it in their descent, they were visible; but below this point they were hid in darkness. The clanking of the chains, the groaning of the pumps, the hallooing of the miners, the creaking of the blocks and wheels, the trampling of horses, the beating of the hammers, and the loud and frequent subterraneous thunder from the blasting of the rocks by gunpowder, in the midst of all this scene of excavation and uproar, produced an effect which no stranger can behold unmoved. We descended with two of the miners and our interpreter into this abyss. The ladders, instead of being placed like those in our Cornish mines, upon a series of platforms as so many landing-places, are lashed together in one unbroken line, extending many fathoms; and, being warped to suit the inclination or curvature of the sides of the precipices, they are not always perpendicular, but hang over in such a manner that even if a person held fast by his hands, and if his feet should happen to slip, they would fly off from the rock, and leave him suspended over the gulf. Yet such ladders are the only means of access

to the works below; and, as the laborers are not accustomed to receive strangers, they neither use the precautions, nor offer the assistance, usually afforded in more frequented mines. In the principal tin-mines of Cornwall the staves of the ladders are alternate bars of wood and iron; here they were of wood only, and in some parts rotten and broken, making us often wish, during our descent, that we had never undertaken an exploit so hazardous. In addition to the danger to be apprehended from the damaged state of the ladders, the staves were covered with ice or mud, and thus rendered so cold and slippery that we could have no dependence upon our benumbed fingers, if our feet failed us. Then to complete our apprehensions, as we mentioned this to the miners, they said, 'Have a care! It was just so, talking about the staves, that one of our women fell, about four years ago as she was descending to her work.' 'Fell,' said our Swedish interpreter, rather simply. 'and pray what became of her?' 'Became of her,' continued the foremost of our guides, disengaging one of his hands from the ladder, and slapping it forcibly against his thigh, as if to illustrate the manner of the catastrophe, 'she became (pankaka) a pancake.'

'As we descended farther from the surface, large masses of ice appeared, covering the sides of the precipices. Ice is raised in the buckets with the ore and rubble of the mine: it has also accumulated in such quantity in some of the lower chambers, that there are places where it is fifteen fathoms thick, and no change of temperature above prevents its increase. This seems to militate against a notion, now becoming prevalent, that the temperature of the air in mines increases directly as the depth from the surface, owing to the increasing temperature of the earth under the same circumstances; and in the same ratio; but it is explained by the width of this aperture at the mouth of the mine, which admits a free passage of atmospheric air. In our Cornish mines ice would not be preserved in a solid state at any considerable depth from the surface.

'After much fatigue, and no small share of apprehension, we at length reached the bottom of the mine. Here we had no sooner arrived, than our conductors, taking each of us by an arm, hurried us along through regions of thick-ribbed ice and darkness, into a vaulted level, through which we were to pass into the principal chamber of the mine. The noise of countless hammers, all in vehement action, increased as we kept along this level; until at length subduing every other sound we could no longer hear each other speak, notwithstanding our utmost efforts. At this moment we were ushered into a prodigious cavern, whence the sounds proceeded; and here, amidst falling waters, tumbling rocks, steam, ice, and gunpowder, about fifty miners were in the very height of their employment. The magnitude of the cavern, over all parts of which their labors were going on, was alone sufficient to prove that the iron ore is not deposited in veins, but beds. Above, below, on every side, and in every nook of this fearful dungeon, glimmering tapers disclosed the grim and anxious countenances of the miners. They were now driving bolts of iron into the rocks, to oore cavities for the gunpowder for blasting. Scarcely had we recovered from the stupefaction occasioned by our first introduction into this Pandæmonium, when we beheld, close to us, hags more horrible than perhaps it is possible for any other female figures to exhibit, holding their dim quivering tapers to our faces, and bellowing in our ears. One of the same sisterhood, snatching a lighted splinter of deal, darted to the spot where we stood, with eyes inflamed and distilling rheum, her hair clotted with mud, dugs naked and pendulous; and such a face, and such hideous yells, as it is impossible to describe:—

Black it stood, as Night—fierce as ten Furies—
Terrible as hell.

If we could have heard what she said, we should not have comprehended a syllable; but as several other Parcæ, equally Gorgonian in their aspect, passed swiftly by us, hastening tumultuously towards the entrance, we began to perceive, that, if we remained longer in our present situation, Atropos might indeed cut short the threads of our existence; for the noise of the hammers had now ceased, and a tremendous blast was near the point of its explosion. We had scarcely retraced with all speed our steps along the level, and were beginning to ascend the ladders, when the full volume of the thunder reached us, as if roaring with greater vehemence because pent among the crashing rocks, whence, being reverberated over all the mine, it seemed to shake the earth itself with its terrible vibrations.'

The following is an improved process for *hardening* steel. Articles manufactured of steel for the purpose of cutting are, almost without an exception, hardened from the anvil; in other words, they are taken from the forger to the hardener without undergoing any intermediate process; and such is the accustomed routine, that the mischief arising has escaped observation. The act of forging produces a strong scale or coating, which is spread over the whole of the blade; and, to make the evil still more formidable, this scale or coating is unequal in substance varying in proportion to the degree of heat communicated to the steel in forging; it is, partially, almost impenetrable to the action of water when immersed for the purpose of hardening. Hence it is that different degrees of hardness prevail in nearly every razor manufactured: this is evidently a positive defect; and, so long as it continues to exist, great difference of temperature must exist likewise. Razor-blades not unfrequently exhibit the fact here stated in a very striking manner: what are termed clouds, or parts of unequal polish, derive their origin from this cause, and clearly and distinctly, or rather distinctly though not clearly, show how far this partial coating has extended, and where the action of the water has been yielded to, and where resisted. It certainly cannot be matter of astonishment, that so few improvements have been made in the hardening of steel, when the evil here complained of so universally obtains as almost to warrant the supposition that no attempt has ever been made to remove it. The remedy, however, is easy and simple in the ex-

treme, and so evidently efficient in its application, that it cannot but excite surprise, that, in the present highly improved state of our manufactures, such a communication should be made as a discovery entirely new.

Instead, therefore, of the customary mode of hardening the blade from the anvil, let it be passed immediately from the hands of the forger to the grinders; a slight application of the stone will remove the whole of the scale or coating, and the razor will then be properly prepared to undergo the operation of hardening with advantage. It will be easily ascertained, that steel in this state heats in the fire with greater regularity, and that when immersed, the obstacles being removed to the immediate action of the water on the body of the steel, the latter becomes equally hard from one extremity to the other. To this may be added that, as the lowest possible heat at which steel becomes hard is indubitably the best, the mode here recommended will be found the only one by which the process of hardening can be effected with a less portion of fire than is, or can be, required in any other way.

We will now direct our reader's attention to a very important, though simple process connected with the hardening and preservation of steel, for which the scientific world is mainly indebted to Mr. Pepys of the Poultry. In his manufactory the tempering, or reduction of the hardening, is not governed by the color only, but by a more accurate method; the exact variations of temperature are given in a fluid, into which a Fahrenheit's thermometer graduated to the boiling point of mercury is immersed, and the delicacy of this operation may be sufficiently understood from the various colors produced on the steel at the various temperatures shown by the thermometer. The change or scale takes place at 430°, and finishes at nearly 600°. Nine changes of colors are observable at about 20° distance of each other.

430° Slight color inclining to yellow.
450 Straw color, pale.
470 Yellow.
490 Brown.
510 Brown with purple spots.
530 Purple
550 Bright blue.
560 Blue.
600 Blackish blue inclined to scale or oxyd.

From 430 to 470 is chiefly employed for razors and some of the finer edged surgical instruments, 470 and 490 for penknives, and some pointed instruments. From 510 to 550 includes pocket-knives, table-knives, carvers, scissors, &c., &c.

The experience of the workman is much required, and also a knowledge for what purpose the edge is to be employed, during these three ranges of temperature.

Of amalgamation.—The process of amalgamation in procuring the precious metals, to which we have already briefly adverted, is but little practised in this country, and yet its value has been generally admitted by the leading chemists both in South America and Europe. The treatise on this subject published by Baron Born in Germany is very rare, and but little known in this country, and we have been favored by a perusal of those parts that have been since translated by Mr. Raspe, which now makes the whole process both plain and intelligible. Amalgamation is the solution of metals in quicksilver. It depends on their elective affinities. Its object and use is either the purification of gold, silver, and other metals, or other mechanical purposes, of which there is no occasion to speak in this place.

The affinity of quicksilver with gold and silver was well known in the remotest antiquity. Vitruvius tells us how gold may be recovered by it from embroidery and old clothes. On this affinity also depends the gilding of metals and brass, which Pliny mentions. All our gold and silver smiths, and many other trades, are acquainted with it. From time immemorial quicksilver has been used in the streaming for gold, in order to purify, and collect into one body the gold dust, which is dispersed in the sands. To obtain these ends, the auriferous sand, brought into a smaller compass by washing, is mixed and triturated with quicksilver; and the amalgam, or solution of the gold, is pressed through a piece of leather, which separates the abundant quicksilver. The Gipsies on the banks of the Arannyos in Transylvania, the Russians on the banks of the Okka, the Americans in their stream works in Chili, and the Germans on the banks of the Rhine, use it in the same manner. The miner applied it for the same purposes, fetching auriferous stones from under ground, and pounding them to sand, which he afterwards triturated with quicksilver in particular mills. Of these quick mills, Agricola has left us an accurate account. Metallurgy being much improved in Germany since the days of Agricola, it was found that only part of the gold was extracted in these mills; that, to obtain the whole, the leavings must go to the fire; and that the gold taken up by the quicksilver must be parted from the silver. All this took away much of the credit of these quick mills; they began soon to be looked upon as superfluous. The gold was separated by washing, only from the first and richer stuff of the stamps; the poorer sorts went to the fire, and the gold was parted from silver by quartation. However, in some mines in the Zillerthal in Tirol, at Gasteris in Salzburgh, in some gold works in Savoy and Chili, which produce native gold, these quick mills are still in use for the purposes of dry or wet amalgamation. By Schlutter's account, the native silver of Kongsberg in Norway was also extracted in quick mills, till they fell into disrepute on account of the large quantities of silver they left in the residuum.

Burning and calcination of the ores promote amalgamation, in so far as it promotes their pulverisation, and assists the quicksilver, chiefly in the treatment of gray silver and copper ores. The best symptom of sufficient calcination is their change of color and loss of brightness. All bright ores must be calcined, but with great care that no vitriol may be disengaged, for that prevents the amalgamation, or, by the subsequent saline additions, produces a salt, which dissolves the metals, and makes them unfit to unite with the quicksilver. These and other circumstances

make fusion and treatment in furnaces frequently preferable to amalgamation, chiefly where there is plenty of wood and firing. Circumstances must determine whether it be better to grind and pulverise them before or after calcination. Their value and contents are better found by the calcination of the pulverised stuff. During the calcining fire it must be constantly stirred and turned about. From time to time some powder is taken from the furnace, and tried with quicksilver and salt, which presently shows the nature of the ore. The inspissation of the quicksilver, or the grain of the stuff, informs the artist whether or what addition it may require, and whether the calcination is perfected or not. The calcination of ores in lumps does not act equally upon all their parts; nor can the fire penetrate them every where. But it is attended with a smaller loss of dust, and saves much trouble and expense in the stamps and mills.

The irony ores, which resist the fire longer, are calcined with an addition of sulphur, or of sulphureous and antimonial stuff, proportioned to the iron they contain. Sulphureous and antimonial ores require calcination with iron scoria. The arsenical ores, or those which are mixed with orpiment and sandarac, are calcined with lead glance; and those which are infected with light or black bitumen must be exposed to the calcining fire with iron scoria or pounded limestone.

To determine the impurities of ores, and their proper additions, pound them coarsely, and throw them upon a heated iron plate. If the smoke be white or black, it is a symptom of white or black bitumen; if yellow, it argues orpiment; if red, sandarac; if yellow and greenish, it implies sulphur. The ores or halvan stuff must never be calcined with salt, for it would calcine the silver. The duration of the calcining fire cannot be determined but by the apparent loss of brightness and change of colors which the ores undergo, and by the test of quicksilver; if, when triturated with some of the calcined stuff, it remains white and pure, and takes a silver color, the calcination is completed. Besides this general rule, there are some other symptoms. If antimonial and sulphureous ores do no longer send forth a suffocating or disagreeable smoke, if the thick black smoke of bituminous ores turns white, and if the silver in the stuff appears in white glittering sparks, in all these cases the calcination is perfected. Able masters will obtain the same and even in the calcination of paco's, negrillo's, and other vitriolic ores, though they require a longer calcining heat and various additions of alum and salt; but then they require no further addition in the subsequent operations, and the quicksilver will take up all their silver in the course of four days. Also less quicksilver will be lost; for, as there is no occasion for the frequent turning and working of the heap, it cannot be worked into impalpable and irrecoverable dust.

One circumstance cannot be too strongly recommended; it is, that vitriolic ores must always be lixiviated before they go to the calcining fire. If the calcined stuff be suspected of being vitriolic, it must be tried by quicksilver; if it takes a lead color, the stuff must be washed till iron put into it does no longer take a copper color. The lixivium of the vitriolic stuff, or ore, is preserved as a useful addition to some ores.

Before the master dresses his heap, he mixes the fine and sifted powder, and takes a sample of three or four pounds for the assay by fire. According to the produce he calculates the contents of the whole for his government. Moreover, he tries the same with quicksilver, to come at the method how the whole is to be treated, and to learn what additions will be required. First he lixiviates the stuff, to extract the sulphate of copper. Then he takes one pound of the lixiviated stuff and tries it by trituration with salt and quicksilver, carefully observing its color and change. If the quicksilver takes the color and form of silver filings, and these quicksilver flakes turn thinner and thinner, it is proof that the amalgamation goes on successfully, and that there is no occasion for any addition. The whole is stirred from time to time, till the quicksilver seems to diminish, and to recover its natural globular form without dividing into small globules. Then the stuff is washed, all the silver being then completely taken up. Formerly the complete extraction of silver by amalgamation, without other additions, was looked upon as impossible; but the ores of Verenguela de Pacagés are actually treated only with quicksilver and salt, and yet they yield their full produce. If the quicksilver takes a lead color, which the Spanish miners call plomo, then the heap requires additions of iron, lead, tin, quicklime, and ashes; for, with them, any silver or ore may be amalgamated. If it turns black, iron is added; if a light lead color tin,; if a dark lead color, lead; if it takes a yellowish or gold color, which implies copper, it requires an addition of lime.

It often divides into small white powdery globules, in consequence of the gravity or hardness of the mineral. This chiefly happens in the amalgamation of lead glance, marcasite, and other bright minerals; or in that of uncalcined hard matrices or loadstones. It likewise arises from too much stirring; and may be obviated by previous calcination of the stuff, or by less stirring. Yet this quicksilver dust is hardly to be avoided in great operations. It serves the workmen for a measure of their progress, nay even for a direction how to operate. This dust is called by different names. The whitish dust, which arises simply from too great division, is called quicksilver dust. What arises from the amalgama of lead and tin is called dust of addition; and what comes from the silver amalgama, silver dust. They are easily distinguished. Quicksilver dust is white, without any quickness, hardly moving when the stuff is stirred with water; it rather sticks to the bottom, and on rubbing it between the fingers it clots into globules. The silver dust sinks towards the coarser stuff on the bottom, and floats about in larger or smaller flakes; rubbed and pressed between the fingers it turns into an amalgama. The dust of addition is, as it were, intermediate between the two. Pressed between the fingers or rubbed, it unites with the quicksilver, which

had begun to combine with silver. These different powders are produced during the amalgamation and washing, by too frequent stirring and turning, chiefly when lead, marcasite, and irony ores are in the mixture; also by sulphate of copper, which in particular brings on this too minute division of the quicksilver; and likewise by too abundant addition of salt, which inspissates the water, and prevents the quicksilver particles from falling to the bottom. They are commonly of the color of quicksilver, and of a white, black, and lead color; like the color of the quicksilver they indicate the various imperfections of the heap in hand, and their respective remedies.

When the master is fully informed, by smaller assays, of the quality and produce of his stuff, of the additions it requires, and of the circumstances which may attend his operations, he accordingly regulates his heap and his proceedings. The heap is wetted with water and mixed with the proper quantity of salt. In the beginning, but one-third of the quicksilver and one-half of the tin and lead are added. During the first two days, it is but once turned over every day, because the quicksilver then uncombined with silver would be apt to fly into very minute globules, and consequently bring on great loss of quicksilver dust. Moreover, too much quicksilver chills the heap, and its amalgamation should rather be assisted by heat. For these reasons it is but gradually added; and though, for want of quicksilver, the work should but slowly proceed in the beginning, yet this may easily be remedied afterwards.

The additions of tin and lead are always thrown into the heap together with the quicksilver. Too much of either hurts the process, for they deaden the quicksilver, and make it unfit for taking up the silver.

Both quicksilver and other additions must be proportioned according to circumstances; observing that the quantities added at a time must be less and less, the more the amalgamation approaches perfection: otherwise the whole would be overloaded with, and swim in quicksilver, whereas it should be kept rather dry, and two parts of amalgama to be in the heap to one of quicksilver. Some masters are of opinion, that abundance and superfluity of quicksilver cannot be hurtful, provided there be a sufficient quantity or proportion of additional ingredients. But this very abundance is exceedingly hurtful, by the great quantity of quicksilver dust which must arise from the turning of the stuff; moreover, if by some accident the additional ingredients should be wasted or destroyed, the dust of addition will change into quicksilver dust, which, having hardly any weight, will not fall to the bottom, but swim on the surface, and run off with the water. If the addition is lime, the whole must be added at once, and the heap be turned over for two or three days, till the quicksilver is added. Too much prevents the combination of the two metals, and any inconveniency may be remedied but this.

The heaps are frequently turned and worked over, that the quicksilver may be thoroughly mixed with the stuff, and take up the silver contained in it. The turning heats the quicksilver and so far assists its attraction. The frequent rubbing purifies the silver. From the difference of their constituent parts, the heaps and the difference of ores are subject to different accidents. The respective progress and obstacles of the amalgamation best appear by fine pulverisation of the stuff; and the quicksilver is the mirror in which all that appears clearly.

The quicksilver deadened by too abundant addition of lead, tin, iron, and lime, loses its oval and affects a vermicular form. Shaken in a glass or other vessel by itself, without any water, it adheres to the sides as it were in strings like thread. Thus circumstanced it is unfit for taking up silver. Its best remedy is sulphate of copper, or the lixivium of vitriolic ores, which was spoken of before. The other base metals, which by their cold nature had deadened the quicksilver, are changed by this sulphate of copper into an oxide, the quicksilver is thereby warmed and restored to life and activity. For the same purpose copper powder is thrown into the heap, and vitriol is the chief ingredient of all the additions which are intended to warm the quicksilver. Thus copper ore is calcined, and when ground fine two parts of it are mixed with one part of salt. Then it is calcined once more, adding half a pound of brass filings to 1 cwt.; or equal parts of fine and coarse stuff and salt are calcined together; or equal parts of copper ore, coarse stuff, and salt; or equal parts of copper ore, coarse stuff, iron scoria, and of the fine silver stuff. They are formed into a paste and cakes which are calcined. These solvents must be thrown into the heap very cautiously, and in consequence and by the direction of smaller assays, which determine what quantity of vitriol will do it good, or disagree with it. The heaps which have too much vitriol, and no additional remedies, give a lead color to the quicksilver. Its quickness is not affected, any more than that its smaller particles appear not in a convex but spherical form.

To obviate this evil, and to protect the quicksilver against the corrosion and action of the vitriol, iron is added, as having a particular power to recal it to life, and to bring it again into one body. But, as there is no certain rule for its proportion, small samples of the heap should be submitted to experiment, nor the heap be turned over till that proportion be fully determined. Sometimes, on examining the heap whilst it is turning, the quicksilver appears in small globules connected as a bunch of grapes. This implies salt, which covers the quicksilver and prevents its combination. It is remedied by the addition of some coarse stuff, which, on being turned with the heap, cleanses the quicksilver. Some add ashes; but the best and most natural remedy is alum, which abounds at Potosi, and whitens the silver. If the heap be not turned equally, and the quicksilver be not added at the proper time, or the silver does not unite with it, dry silver will arise, and lie on the coarser stuff like cobweb, which, if not skimmed off in time, is carried off by the washing water. To collect this dry silver, and the finest quicksilver dust, some silver amalgama is pressed upon

it through a chamois skin, and the whole is once more turned and worked over. The frequent turning, the heat of climate and season, the fermentation produced in the heap by the vitriol, and other additions, all co-operate in the amalgamation, and promote its success; whereas cold weather, neglect of stirring, and the lead color of the quicksilver prevent it.

It is very difficult to determine upon the maturity of the heap, when all the silver is taken up, and when it may go to the washing. And yet much depends upon it. If washed too soon, silver is lost in the leavings; if worked too long there is loss of quicksilver, time, and labor. The symptoms of maturity hitherto mentioned are all of them exceedingly uncertain and fallacious. The heap may appear not to require any additional quicksilver; the silver dust may appear to be completely collected; that of quicksilver may begin to make its appearance; the amalgama may begin to appear pure, and to show a gold color; and yet silver may remain in the leavings. The most infallible test of the maturity of the heap is the assay of the triturated stuff by fire. If no silver is produced thereby, then so much quicksilver is thrown into the heap, that it may contain three parts amalgama to two of silver, or at least one part quicksilver to two of amalgama. By this additional fresh quicksilver, all the dust of quicksilver, and the dry and uncombined silver, are perfectly collected; the amalgama is the heavier for it, and sinks the more readily to the bottom, when brought to the washing-tub. Some clean quicksilver is also put into the bottom of this tub; the inside of which must be lined with iron plate, well cleaned, and rubbed with quicksilver. The stuff brought into the tub must be diluted with a great quantity of water, and be stirred round with a pestle, lined with iron plate in such a manner that it may turn round six times one side, and six times the other, always touching the bottom; the unconnected bodies of quicksilver and amalgama are thereby to meet, to combine, and to fall to the bottom. To recover the salt, which had been mixed with the heap, the water, which is first thrown upon the stuff in the washing-tub, is collected, and by evaporation the salt falls to the bottom. The whole having thus been washed over, and the quicksilver being collected into one body, nothing remains in the tub but some fine quicksilver dust, which ought to be collected by a piece of leather or cloth. Then the whole is pressed through a piece of leather or wet cloth. The amalgama thereby obtained is beaten into a pyramidal or conical mould, and called pinna. 100 lbs. of amalgama commonly produce a pinna of silver of forty marcs. The finest particles of silver pass with the quicksilver through the pressing bag; and in the boxes, in which it is preserved for further use, crusts of silver amalgama collect at the bottom. More silver runs off with warmed quicksilver. The amalgama formed into conical pinnas is commonly distilled from earthen retorts into similar receivers, in order to free it from its quicksilver; or the same distillation is performed in iron vessels, by which nothing is lost of the quicksilver fumes.

P. Joseph Acosta gives the following account of the amalgamation of gold and silver ores:—'Commonly 6000 or 7000 cwt. of quicksilver are consumed at Potosi in the dressing of the ore, not to mention what is recovered from the leavings of the first washing. These leavings, called lamas, are burnt in particular furnaces in order to extract the remaining quicksilver. There are upwards of fifty such furnaces near Potosi and Tarapaja. The ore annually refined amounts to about 300,000 cwt. from the leavings of which nearly 2000 cwt. of quicksilver are recovered. Let us observe that the ores are of a different nature. Some are rich, and require but little quicksilver; others produce little and consume a great quantity; others again produce and destroy much of it. Commonly the richest requires most, and vice versâ; and profit and loss in mining depend on the quality of the ore. The ore is first pulverised in mills, and then passed through iron or brass sieves. Properly built and regulated, these mills will grind 30 cwt. in the space of twenty-four hours. The pulverised stuff is put into heaps in the open air, and salt is mixed with it in the proportion of 5 cwt. to 50 cwt. in order to macerate and cleanse it of its impurities, that it may be the better acted upon by the quicksilver. Upon these heaps, and whilst they are stirring, the quicksilver is pressed through a coarse cloth, through which it comes as a drizzling rain in small globules. Before the fire-places were invented, the ore was repeatedly kneaded with quicksilver in wooden troughs, and formed into large round masses, which were left in that form for a couple of days. Then they were worked again till the quicksilver appeared embodied with the silver, which sometimes would take twenty and more, but at least nine days. When it was found that fire assists this incorporation of the silver, ovens were built, in which the mixture of salt, quicksilver, and ores, is generally heated, and the quicksilver appears to be incorporated in the course of five or six days. When the quicksilver has taken up the silver, and wholly separated it from its matrix, the lead and the copper, the ovens are opened, the stuff is taken out, and the quicksilver is expelled and recovered in the following manner:—

'The mixture is put into water-troughs, and stirred therein by means of mills and water wheels, whereby the earthy and extraneous particles are washed away, and the quicksilver with the silver settles at the bottom. The sediment looks like sand. It is further washed over in flat plates, and perfectly cleansed; what goes off with the water is collected, and further made use of under the name of relaves.

'When in this manner the amalgama is cleansed and bright, it is put into a cloth and squeezed out. The uncombined quicksilver runs off, and the remaining body of amalgama contains five parts of quicksilver, and one of silver. This amalgama is made into silver masses, called pinnas, which have the form of a sugar loaf, are hollow within, and commonly weigh 100 lbs. To expel the quicksilver, they are exposed to a strong fire, and covered with an earthen cap or helmet, of the form of a sugar loaf, which is externally surrounded with coal. The heat evaporates the quicksilver in the form of steam,

which coming in contact with the earthen cover is condensed, and runs off by a pipe into a vessel filled with water, so that the quicksilver is recovered, and the silver purified. Though the silver still appears in the form of amalgama, yet it loses five parts of its weight, and looks spongy. The silver, thus collected and purified, is so fine that silversmiths cannot work it without alloy, and even in the mint some alloy must be added.'

Another writer on this subject says, 'The ores must be calcined in furnaces like lime-kilns, and the calcining fire must be kept up according to the nature of the ores; afterwards they may be pulverised in hand, horse, or water-mills, or in stamps. The pulverised stuff is passed through fine iron sieves, and then put into earthen or copper vessels by 20 or 10 cwts. More or less salt is mixed with it, according to circumstances. The light-colored stuff requires 50 lbs. per 1000, the darker somewhat more. To this is to be added 5 lbs. dry tartarus, 2 lbs. pulverised horn, and 3 lbs. brick-dust. More or less of these additions is required; but that depends so much on the nature of the ores, that some of them require but a small part of these additions. After this mixture has been put into the boiler, a sufficient quantity of water must be added, that the whole may be pounded into a kind of paste, neither too thick nor too thin; and the vessels must be exposed to the sunshine, for the operation succeeds better in summer than winter, when it is performed in warm rooms. When the paste begins to dry, some water must be added, and it must be worked over by pounding three or four times a day. At the expiration of three or four days, various colors appear on the surface. Then 15 lbs. of sulphur per 1000 must be added, and the whole must be worked over again. At last 100 lbs., or, if the ores are of a mild nature, a less quantity of quicksilver is added; the whole mass is carefully worked over, and left at rest to settle for about ten hours. Then fire is kindled under the boiler, and the stuff contained in it must be stirred or triturated for two days together, observing that a proportionate quantity of water may always keep it sufficiently liquid and diluted. At last, let it repose for twelve hours; let it dry, and take it out. If the ores were rich and well worked, particles and globules of quicksilver amalgama appear in it, which are collected, washed out, and kept for further use. The leavings are carried to a place fit for washing them over. This place must be on the slope of a hill, where a kind of pit is dug out and lined with brick and mortar. It must hold about 25 cwt. of the triturated stuff. Running water is led upon it, and it must be stirred without interruption. The superflous water runs off over the rim of the pit, and carries off the lighter particles gradually. When all the earthy and stony particles are thus washed off, the silver amalgama at the bottom is taken out, and, together with the before said grains or clots of amalgama, it is pressed through a hempen or coarse linen cloth, which may be done by hand, or other mechanical contrivances. The quicksilver, which comes through clean, is kept for future use, the amalgama is evaporated in particular furnaces, and the remaining silver is run into ingots. In this manner all the silver is extracted from every kind of ore in a very short time; and, on account of its inconsiderable expense, even poor ores and poor mines can be worked to advantage.

'In order to extract the gold from its ores, the following practice is put in process:—The auriferous sand, which contains gold-grains and gold-dust, is concentrated by washing, and without any calcination it goes to the just mentioned washing-pit, which for this purpose need not be spacious. On its upper part is fixed a square launder, about twelve feet long, which on its bottom is covered with a woollen cloth, for the purpose of keeping the gold-dust, which may be carried off with the water and stuff gently stirred in the pit. When the water carries off no more mud, but runs off clear, the farther supply is stopped, the water in the pit is pumped or taken out in buckets; the coarser sand in the bottom is separated or scraped off by the hands, and the finer heaviest sand at the bottom is mixed with quicksilver. Then it is squeezed through a piece of cloth; the quicksilver comes off without any gold, which, separated from the sand, remains as an amalgama, and is pure after the adhering quicksilver has been evaporated. The sand and heavier dust remaining on the launder is washed and treated in the same manner. The auriferous ores and loadstones, however, which rise from different mines, are calcined like silver ores, more or less, as the nature of their matrices will direct. Then they are ground and sifted; and the auriferous stuff thus prepared is put into heaps, exposed to the sunshine, and worked and turned about with tartarus and water for about three or four days. It requires no salt. Afterwards sulphur, and at last quicksilver, are added and mixed with it. There is no occasion for fire under the vessel in which it is triturated, except in winter; and two days after, though not dried, it is immediately carried to the washing-pit, and treated like the silver amalgama.

'This method of extracting gold and silver is so certain and safe, that, when other methods of amalgamation extract only one ounce of gold or silver, this produces three or four from the poorest ores in a shorter time, and with less expense.'

Soon after the process of amalgamation had been introduced in Peru, in the year 1588, a Spaniard of the name of Don Juan de Corduba, applied to the court of Vienna, offering to extract the silver from the ores, whether poor or rich, by the means of quicksilver, at a small expense, and within the course of eight or ten days. He was referred to baron Lewis de Hoyos, who laid before him various sorts of ore, from which he is reported to have actually extracted the gold and silver by his method. Upon this he was ordered to make a great experiment upon 20 cwt. of Kultenberg, in Bohemia. From the report of the celebrated Lazarus Erker, then upper bar-master at Kultenberg, and from papers sent in with the same, it appears that Corduba received for the above experiment 20 cwt. dried

mundick stuff of the stamps of five-eighths of an ounce of silver per cwt., which on the 21st of March he mixed with 17 cwt. of quicksilver, and left to macerate nineteen days. On straining 3 cwt. of the triturated stuff, he had no silver, nor could he recover above one-third of the quicksilver. He took afterwards half a cwt. of the calcined stamp stuff of Kultenberg, which he left to macerate ten days; and, straining it, he had but 1 cwt of silver, which was not full the tenth part of the real produce.

The quantity of mercury consumed in the process of amalgamation is thus described by baron Humboldt:—

'Mexico consumes annually upwards of 2,000,000 lbs. troy of mercury. In 1803 a very useful project was formed in Spain of supplying Mexico for several years, in order that, in the unforeseen case of a war, the amalgamation might not be impeded by the want of mercury; but this project (del requesto) shared the fate of many others which have never been executed. Before 1770, when the working of mines was far from being so considerable as at present, New Spain received no other mercury but that of Almaden and Huancavelica. The German mercury furnished by the Austrian government, of which the greatest part is from Idria, was only introduced into Mexico after the falling in of the subterraneous works of Huancavelica, at a time when the mine of Almaden was inundated in the greatest part of its works, and yielded a very inconsiderable produce. But in 1800, and 1802, this last mine was again in such a flourishing state, that it could alone have furnished more than 20,000 cwt. of mercury per annum, and there were sufficient grounds to conceive the hope of a termination of the necessity for recurring to German mercury, for the supply of Mexico and Peru. There have been years when 10,000 or 12,000 cwt. of this last mentioned mercury have been imported at Vera Cruz. Upon the whole, from 1762 to 1781, the amalgamation works of New Spain destroyed the enormous quantity of 25,124,200 lbs. troy, of which the value in America amounted to more than £2,400,000.

'When the price of mercury has progressively lowered, the working of the mines has gone on increasing. In 1590, under the viceroy Don Luis de Velasco II., a cwt. of mercury was sold in Mexico for £40 10*s*. But, in the eighteenth century, the value of this metal had diminished to such a degree, that in 1750 the court distributed it to the miners at £17 15*s*. Between 1767 and 1776, its price was £13 9*s*. per cwt. In 1777, under the administration of the minister Galvez, a royal decree fixed the price of the mercury of Almaden at £8 17*s*. 6*d*. and that of Germany at £13 13*s*. At Guanaxuato these two sorts of mercury are increased by the expensive carriage on the backs of mules, from 8*s*. 8*d*. to 10*s*. 10*d*. per cwt.

'The impartial distribution of mercury (el repartimiento del azogue) is of the greatest consequence to the prosperity of the mines of New Spain. Unfortunately, however, the viceroys and those persons who were about them, under the old government, were jealous of the right of administering this branch of the royal revenue. They knew very well that to distribute mercury, and especially that of Almaden, which is one-third cheaper than that of Idria, was to concede a favor; and in the colonies, as every where else, it is profitable to favor the richest and most powerful individuals. From this state of things, the poorest miners, those of Tasco, Temascaltepec, or Copala, could not procure mercury, when the great works of Guanaxuato and Real del Monte had it in abundance.

The following table proves the influence of the price of mercury on its consumption. The diminution of this price, and the freedom of trade with all the ports of Spain, have jointly contributed to the progress of mining.

Periods.	Price of a cwt. of mercury.	Total consumption of mercury.
	£. s. d.	
1762—1766	17 15 0	35,750 cwt.
1767—1771	13 9 0	42,000
1772—1777	13 9 0	53,000
1778—1782	8 17 6	59,000

'It was known in Mexico, in 1782, that China possesses mercury mines; and it was imagined that nearly 15,000 cwt. might be annually drawn from Canton. The viceroy Galvez sent thither a cargo of otter skins by way of exchange for the mercury; but this project, wise in itself, was badly executed. The Chinese mercury obtained from Canton and Manilla was impure, and contained a great deal of lead; and its price amounted to £17 6*s*. 8*d*. the cwt. Even at this price only a very small quantity could be procured. Since 1793 this important object has been totally lost sight of; yet it is deserving of the utmost attention, especially at a time when the Mexicans experience great difficulty in procuring mercury from the continent of Europe.

'From all the researches which I could make, the whole of Spanish America, namely, Mexico, Peru, Chili, and the kingdom of Buenos Ayres (for elsewhere the process of amalgamation is unknown), annually consume more than 25,000 cwt. of mercury, the price of which in the colonies amounts to more than £250,000 sterling. M. Heron de Villefosse, in an interesting table which contains the quantity of each metal extracted from the mines over the whole globe, estimates the mercury annually drawn from those of Europe at 36,000 cwt. From these data we find that mercury is, after cobalt, the rarest of all metals, and that it is even twice as rare as tin

'The following table indicates the quantity of mercury lost in the processes of amalgamation, used in different districts of mines, to extract the silver from the ore. A loss (perdida y consumo) of 100 lbs. of mercury is computed

	lbs. troy of silver.
In the mines of Guanaxuato, for about	65
In the mines of the intendancy of Guadalaxara	58
In the mines of Pachuca, Zacatecas, Sombrerete, Guadiana, Durango, Parral, Zichu, Tonala, Comanja, Zerralbo, Temextla, Alchichica, Tepeaca, Zimapan, Cairo, and Tlapa	53

In the mines of Chichiapa, Tetala, Tasco, Santa Theresa de Leiba y Banos, Ituquaro, Tehuistla, San Esteban dé Albukquerque, and Chiconasi 48
In the mines of Temascaltepec, Ayuteco, and Chautla de la Sal 44
In the mines of Zacualpa, San Luis Potosi, Guautla, Sultepec, and Tlapujahua . 42

'The government regulates the distribution (repartimiento) of silver, according to these data, and the quantity of silver annually extracted from the different districts of mines.

'The amalgamation of a cwt. of ores, which contain from three and a half to four ounces of silver, costs in Mexico, including the loss of mercury, from 4*s*. to 5*s*. M. Sonneschmidt calculates the loss of mercury at ten, twelve, or fourteen ounces for eight ounces of silver; and he reckons eight ounces of mercury consumed (azogue consumido), and from three to six ounces lost (azogue pirdido).

'From December 1801 till August 1804 Spain received from its colonies £23,250,094 in gold and silver, and £13,725,961 in agricultural produce. From 1788 to 1795 the total importation was only at an average, from £7,000,000 to £10,000,000 sterling per annum.

'The produce of the mines of Spanish America varies a seventh from year to year, or more than 310,000 lbs. troy of silver. We have estimated this produce for the Spanish and Portuguese colonies at 17,291 kilogrammes of gold, or 75,217 Castilian marcs, and at 795,581 kilogrammes or 4460 Castilian marcs of silver, which together are of the value of £9,400,000. Europe, Siberia, and America, furnish per annum 57,368 lbs. in gold, and 2,175,000 lbs. in silver, or to the value of £10,755,000.'

Mercury, when native, and enveloped in much earthy or other matter, from which it cannot be separated merely by washing, is distilled either by ascent or descent. When it is mineralised by sulphur, that is, when it is contained in cinnabar, some intermediate substance, as quicklime or iron, must be added in the distillation, to disengage it from the sulphur.

The rich ore of Almaden in Spain is a cinnabar, with which a calcareous stone happens to be so blended, that no addition is required to disengage the mercury from the sulphur. The distillation is there performed in a furnace consisting of two cavities, one of which is placed above another. The lower cavity is the fire-place, and contains the fuel, resting upon a grate, through the bars of which the air enters, maintains the fire, and passes into a chimney, placed at one side of the fire-place, immediately above the door through which fuel is to be introduced. The roof of this fire-place, which is vaulted and pierced with several holes, is also the floor of the upper cavity. Into this upper cavity, the mineral from which mercury is to be distilled is introduced through a door in one of the sides of the furnace. In the opposite wall of this cavity are eight openings, all at the same height. To each of these openings is adapted a pile of aludels connected and luted together, extending sixty feet in length. These aludels, which are earthen vessels open at each end, and wider in the middle than at either extremity, are supported upon an inclined terrace; and the aludel of each file, that is most distant from the furnace, terminates in a chamber built of bricks, which has two doors and two chimneys.

When the upper cavity is filled sufficiently with the mineral, a fire is made below, which is continued during twelve or fourteen hours. The heat is communicated through the holes of the vaulted roof of the fire-place to the mineral in the upper cavity, by which means the mercury is volatilised, and its vapor passes into the aludels, where much of it is condensed, and the rest is discharged into the brick-chamber, in which it circulates till it also is condensed. If any air or smoke passes through the aludels along with the vapor of the mercury, they escape through the two chimneys of the chamber. Three days after the operation, when the apparatus is sufficiently cooled, the aludels are unluted, the doors of the chamber opened, and the mercury is collected.

The metallurgical processes now resorted to in South America, for procuring the precious metals, are too important to be passed unnoticed. The conduct of the mines is thus described by baron Humboldt:—

The art of mining is daily improving, and the pupils of the School of Mines at Mexico gradually diffuse correct notions respecting the circulation of air in pits and galleries. Machines are beginning to be introduced, in place of the old method of carrying minerals and water on men's backs up stairs of a rapid ascent. In proportion as the mines of New Spain resemble more and more those of Europe, the miner's health will be less injured by the influence of the foul air, and the excessively prolonged efforts of muscular motion.

From 5000 to 6000 persons are employed in the amalgamation of the minerals, or the preparatory labor. A great number of these individuals pass their lives in walking barefoot over heaps of brayed metal, moistened and mixed with muriate of soda, sulphate of iron, and oxide of mercury, by the contact of the atmospheric air and the solar rays. It is a remarkable phenomenon to see these men enjoy the most perfect health. The physicians who practise in places where there are mines unanimously assert, that the nervous affections, which might be attributed to the effect of an absorption of oxide of mercury, very rarely occur. At Guanaxuato part of the inhabitants drink the very water in which the amalgamation has been purified (aqua de lavaderos) without feeling any injury from it. This fact has often struck Europeans not intimately acquainted with the principles of chemistry. The water is at first of a grayish-blue color, and contains in suspension black oxide of mercury, and small globules of native mercury and amalgamation of silver. This metallic mixture gradually precipitates, and the water becomes limpid. It can neither dissolve the oxide of mercury nor the muriate of mercury, which is one of the most insoluble salts we know. The mules are very fond of this water, because it contains a little muriate of soda in solution.

We have already said, that the labor of a

is entirely free throughout the kingdom of New Spain. No Indian or Mestizo can be compelled to devote himself to the working of mines. It is absolutely false, though the assertion has been repeated in works of the greatest estimation, that the court of Madrid sends out galley slaves to work in the gold and silver mines. The mines ot Siberia have been peopled by Russian malefactors, but in the Spanish colonies this species. of punishment has been fortunately unknown for centuries. The Mexican miner is tolerably well paid, as he earns at the least from £1 to £1. 4*s*. per week of six days, while the wages of laborers who work in the open air, hus bandmen for example, are 6*s*. 3*d*. on the central table-land, and 7*s*. 6*d*. near the coast. The miners, tenateros and faeneros, occupied in transporting the minerals to the plats (despachos), frequently gain more than 4*s*. 10*d*. per day of six hours. Honesty is by no means so common among the Mexican as among the German or Swedish miners; they make use of a thousand tricks to steal rich specimens of ores. As they are almost naked, and are searched on leaving the mine in the most indecent manner, they conceal small morsels of native silver, or red sulphuret and muriate of silver, in their hair, under their arm pits, and in their mouths. It is a most shocking spectacle to see in the large mines of Mexico, hundreds of workmen, among whom there are a great number of very respectable men, all compelled to allow themselves to be searched on leaving the shaft or level. A register is kept of the minerals found in the hair, in the mouth, or other parts of the miners' bodies. In the mine of Valenciana, at Guanaxuato, the value of these stolen minerals amounted between 1774 and 1787 to the sum of £63,000 sterling.

In the interior of the mines much care is employed in controlling the tenateros, by whom the ores are carried towards the shaft from the place of operation. At Valenciana, for example, they know to within a few pounds the quantity of work containing ore which daily goes out of the mine. I say, the work, for the rock is never there an object of extraction, and is employed to fill up the vacancies formed by the extraction of the minerals. At the plats of the great shafts, two chambers are dug in the wall, in each of which two persons (despachadores) are seated at a table, with a book before them containing the names of all the miners employed in the carriage. Two balances are suspended before them, near the counter. Each tenatero loaded with ores presents himself at the counter; and two persons stationed near the balances judge of the weight of this load by raising it lightly up. If the tenatero, who on the road has had time to estimate his load, believes it lighter than the despachador, he says nothing, because the error is advantageous to him; but on the other hand, if he believes the weight of the ore he carries in his bag to be greater than it is estimated, he demands that it should be weighed, and the weight which is thus determined is entered in the book of the despachador. From whatever part of the mine the tenatero comes, he is paid at the rate of one real de plata (6¼*d*.) for a load of 2¼ cwt., and one real and a half for a load of 3¼ cwt. per journey. There are some tenateros who perform in one day from eight to ten journeys, and their pay is regulated from the book of the despachador. This mode of reckoning is no doubt highly deserving of praise; and we cannot sufficiently admire the celerity, the order, and the silence with which they thus determine the weight of so many thousand quintals of ores, which are furnished by veins of six or eight fathoms in breadth, in a single day.

These ores, which are separated from the sterile rocks in the mine itself by the master miners (quebradores), undergo three sorts of preparation, viz. at the places for jigging or washing the ores, where women work; under the stamping mills; and under the tahonas or arastras. These tahonas are machines in which the work is ground under very hard stones, which have a rotatory motion, and weigh upwards of seven or eight cwt. They are not yet acquainted with washing with the tub (setz wäsche), nor washing on sleeping tables (tables dormantes) (liegende-heerde), or percussion (stosrheerde). The preparation under the stumps (mazos), or in the tahonas, to which I shall give the name of edge mills, on account of their resemblance to some oil and snuff mills, differs according as the ore is destined to be smelted or amalgamated. The mills properly belong only to this last process; however, very rich metallic grains called polvillos, which have passed through the trituration of the tahona, are also smelted.

The quantity of silver extracted from the ores, by means of mercury, is in the proportion of three and a half to one of that produced by smelting. This proportion is taken from the general table formed by the provincial treasuries, from the different districts of mines of New Spain. There are, however, some of these districts, for example those of Sombrerete and Zimapan, in which the produce from smelting exceeds that of amalgamation.

Silver (plata quintada) extracted from the Mines of New Spain, from the 1st January 1785 to the 31st of December 1789.

Provincial treasuries receiving the fifth.	Silver extracted by amalgamation.	Silver extracted by smelting.
Mexico . .	950,185	104,835
Zacatecas . .	1,031,360	173;631
Guanaxuato .	1,937,895	531,138
San Luis Potosi .	1,491,058	24,465
Durango . .	536,272	386,081
Guadalaxara .	405,357	103,615
Bolanos . .	336,355	27,614
Sombrerete . .	136,395	184,205
Zimapan . .	1,215	247,002
Pachuca . .	269,536	185,500
Rosario . .	477,134	191,368
Total in lbs. Troy	7,572,762	2,159,454

In times of peace amalgamation gains a gradual ascendancy over smelting, which is generally badly managed. As wood is becoming

yearly more scarce on the ridge of the Cordilleras, which is the most populous part, the diminution of the produce of smelting is very advantageous to the manufactories which require a great consumption of combustibles. In time of war the want of mercury arrests the progress of amalgamation, and compels the miner to endeavour to improve the process of smelting. M. Velasquez, the director-general of the mines, supposed even in 1797, before the discovery of the rich mines of Catorse, where there is scarcely any smelting, that of all the ores of New Spain two-fifths were smelted, and the other three-fifths amalgamated.'

The present mode of *smelting gold* at Villa Rica may now be adverted to. All the gold dust brought from the Comarca of Do Oiro Preto, or Villa Rica, comes first into the weighing room, where the escrivão da receita weighs it, and separates the fifth part from it as due to the king; and the escrivão da conferencia enters in the list the quantity of each owner, without and with the deduction. The parts belonging to the king are thrown together, mixed, and melted into large bars; but the four parts belonging to private individuals, into single smaller bars. For this purpose the gold-dust is put into a crucible of proportionate size, and, as soon as it begins to melt, it is kept there for some time with sublimate of mercury. When it appears to be perfectly melted, the metal is poured into a square iron mould, furnished with handles, in which it cools. These moulds are of very different sizes, containing from ten sitavas to an arroba of gold. The various combinations of the gold to be melted with iron, antimony, manganese, or arsenic, determine the time necessary to melt it. Gold which is more difficult to melt is mixed with a greater proportion of sublimate; this is particularly the case with that with which much iron is mingled; the workmen, by long experience, generally know the quantity of the addition which the gold of such mines requires. Very pure gold is perfectly melted in three hours The color of the gold smelted at Villa Rica is of very different hues, from the most beautiful gold-yellow to reddish copper-color, bright yellow, and even gray-yellow; a specimen of every shade is preserved. The gold bar when cut comes into the hands of the assayer, who determines the weight and fineness by the trial with sublimate: for this purpose he takes a piece from one end of the bar, and in difficult cases from both. In bars from well known mines the trial is made only with the touch-stone; for which are kept, on copper pins, the specimens from sixteen to twenty-four carats, each of which is divided into eight equal parts. The purest gold smelted at Villa Rica is of twenty-three carats and seven-eighths. The mines of Villa Rica generally produce gold from twenty to twenty-three carats; those of Sabará and Congontras de Sabará, from eighteen to nineteen carats; that from the Rio das Valhas near Sabará gives from nineteen to twenty. The gold of Cocaës and Inficionado is very pure, though not of a very fine yellow, but often pale or copper-colored. When the weight and fineness, and consequently the value, of the bar are determined and entered in the list, the Brazilian arms, the number of the list, the mark of the smelting-house, the date of the year, and the degree of fineness, are stamped upon it, and a printed ticket is given with the bar, which, besides all the above particulars, states the value in rees, the weight which the proprietor gave in gold-dust, and how much was deducted for the king. Without this instrument, signed by the officers of the smelting office, the bar, which is returned to the owner, cannot legally pass instead of coin. It is strictly prohibited to export it from the province of Minas without notice; because the royal mints are to repurchase the bars for their nominal value in ready money. But as an agio of ten per cent. is offered for the bars, even on the coasts of Brasil, this species of fraud is very common.

Arsenic, zaffre, and bismuth, are obtained generally from one ore, namely, that called cobalt. The arsenic of the ore is separated by roasting, and adheres to the internal surface of a chimney, which is extended horizontally about 200 or 300 feet in length, and in the sides of which are several doors, by means of which the arsenic, when the operation is finished, may be swept out and collected. These chimneys are generally bent in a zig zag direction that they may better retard and stop the arsenical flowers. These flowers are of various colors, white, gray, red, yellow, according to the quantity of sulphur or other impurity with which they happen to be mixed. They are afterwards purified by repeated sublimations, while some alkaline or earthy substances are added to detain the sulphur, and to assist the purification.

In the same roasting of the ore by which the arsenic is expelled, the bismuth, or at least the greatest part of this semi-metal which is contained in the ore, being very fusible, and having no disposition to unite with the regulus of cobalt, which remains in the ore, is secured by liquefaction.

The remaining part of the roasted ore consists chiefly of calx of regulus of cobalt, which not being volatile as the arsenic is, nor so easily fusible as bismuth is, has been neither volatilised nor melted. It contains also some bismuth, and a small quantity of arsenic, together with any silver or other fixed metal which happened to be contained in the ore. This roasted ore being reduced to a fine powder, and mixed with three or four times its weight of fine sand, is the powder called saffre or zaffre. Or the roasted ore is sometimes fused with about thrice its quantity of pure sand and as much pure potash, by which a blue glass called smalt is produced, and a metallic mass, called speiss, is collected at the bottom of the vessel in which the matters are fused. The metallic mass or speiss is composed of very different substances, according to the contents of the ore and the methods of treating it. The matters which it contains at different times are, nickel, regulus of cobalt, bismuth, arsenic, sulphur, copper, and silver. Bismuth is seldom procured from any other ores but that of cobalt. It might, however, be extracted from its proper ores, if a sufficient quantity of these were found, by the same method by which

it is obtained from cobalt, namely, liquefaction.

Before metallic ores are worked upon in the large way, it will be necessary to enquire what sort of metal, and what portion of it, is to be found in a determined quantity of the ore; to discover whether it will be worth while to extract it largely, and in what manner the process is to be conducted, so as to answer that purpose. The knowledge requisite for this is called the art of ASSAYING, and has already been briefly adverted to under that article.

The assaying of ores may be performed either in the dry or moist way; the first is the most ancient, and in many respects the most advantageous, and consequently still continues to be mostly used.

Assays are made either in crucibles under the blast of the bellows, or in tests under a muffle. The assay weights are always imaginary, sometimes an ounce represents a hundred weight on the large scale, and is subdivided into the same number of parts as that hundred weight is in the great; so that the contents of the ore obtained by the assay, shall accurately determine, by such relative proportion, the quantity to be expected from any weight of the ore on a larger scale.

In the lotting of the ores, care should be taken to have small portions from different specimens, which should be pulverised, and well mixed in an iron or brass mortar. The proper quantity of the ore is now taken, and if it contain either sulphur or arsenic, it is put into a crucible or test, and exposed to a moderate degree of heat, till no vapor arises from it; to assist this volatilisation, some add a small quantity of powdered charcoal. To assist the fusion of the ores, and to convert the extraneous matters connected with them into scoria, assayers use different kinds of fluxes. The most usual and efficacious materials for the composition of these are borax, tartar, nitre, sal ammoniac, common salt, glass, fluor-spar, charcoal powder, pitch, lime, litharge, &c., in different proportions. The crude of white flux consists of one part of nitre, and two of tartar, well mixed together.

The above crude flux detonates by means of kindled charcoal; and, if the detonation be effected in a mortar slightly covered, the smoke that rises unites with the alkalised nitre and the tartar, and renders it black.

Cornish reducing flux: 10 oz. of tartar, 3 oz. and 6 drachms of nitre, and 3 oz. and 1 drachm of borax; mixed well together. Cornish refining flux: deflagrate, and afterwards pulverise 2 parts of nitre and 1 part of tartar.

The above fluxes answer the purpose very well, provided the ores be deprived of all their sulphur, or if they contain much earthy matter, because in the latter case they unite with them and convert them into a thin glass; but, if any quantity of sulphur remain, these fluxes unite with it, and form a liver of sulphur, which has the power of destroying a portion of all the metals; consequently the assay, under such circumstances, must be very inaccurate. The principal difficulty in assaying appears to be in the appropriation of the proper fluxes to each particular ore; and it likewise appears that such a discriminating knowledge can only be acquired from an extensive practice, or from a knowledge of the chemical affinities and actions of different bodies upon each other.

In assaying, we are at liberty to use the most expensive materials to effect our purpose; hence the use of different saline fluxes; but, in the working at large, such expensive means cannot be applied, as by such processes the inferior metals would be too much enhanced in value, especially in working very pure ores. In consequence of which, in smelting works where the object is the production of metals in the great way, cheaper additions are used, such as limestone, feldt-spar, fluor-spar, quartz, sand, slate, and slags. These are to be chosen according to the different views of the operator, and the nature of the ores. Thus, iron ores, on account of the argillaceous earth they contain, require calcareous additions, and the copper ores, rather slags or vitrescent stones, than calcareous earth.

The mode of assaying ores for their particular metals, by the dry way, is deficient so far as relates to pointing out the different substances connected with them, because they are always destroyed by the process for obtaining the assay metal. The assay by the moist way is more correct, because the different substances can be accurately ascertained. The late celebrated Bergman first communicated this fact. It depends upon a knowledge of the chemical affinities of different bodies for each other: and must be varied according to the nature of the ore; it is very extensive in its application, and requires great patience and address in its execution. To describe the treatment of each variety of metallic ores would take up too much of our room; but, to give a general idea, we shall describe the procedure, both in the dry and the humid way, on one species of all the different ores.

To assay iron ores.—The ore must be roasted till the vapor ceases to rise. Take two assay quintals of it, and triturate them with one of fluor-spar, three-fourths of a quintal of powdered charcoal, and four quintals of decrepitated sea salt; this mixture is to be put into a crucible, lined on the inside with clay and powdered charcoal; a cover must be luted upon the crucible, and the crucible itself exposed to a violent fire for an hour, and, when it is cool, broken; when, if the operation has been well conducted, the iron will be found at the bottom of the crucible; to which must be added those metallic particles which may adhere to the scoria. The metallic particles so adhering may be separated by pulverising it in paper, and then attracting them with a magnet. If the ore should be in a calciform state, mixed with earths, the roasting of it previous to assaying, if not detrimental, is at least superfluous; if the earths should be of the argillaceous and siliceous kind, to half a quintal of them add of dry quick lime and fluor-spar of each one quintal and a quarter, reduced to powder, and mix them with one quarter of a quintal of powdered charcoal, covering the whole with one ounce of decrepitated common salt; and expose the luted crucible to a strong forge fire for an hour and a quarter; then let it gradually cool, and let the regulus be struck off

and weighed. If the ore contain calcareous earth, there will be no occasion to add quicklime; the proportion of the ingredients may be as follows, viz. one assay quintal of the ore, one of decrepitated sea salt, half a quintal of powdered charcoal, and one of fluor-spar, and the process conducted as above. There is a great difference in the reguli of iron; when the cold regulus is struck with a hammer and breaks, the iron is cold-short; if it break on being struck red-hot, it is called red-short; but if it resist the hammer both in its cold and ignited state it is good iron.

Humid assay of iron ore.—To assay the calciform ores, which do not contain much earthy or stony matter, they must be reduced to a fine powder, and dissolved in the marine acid, and precipitated by the Prussian alkali. A determinate quantity of the Prussian alkali must be tried previously, to ascertain the portion of iron which it will precipitate, and the estimate made accordingly. If the iron contain any considerable portion of zinc or manganese, the precipitate must be calcined to redness, and the calx treated with dephlogisticated nitrous acid, which will then take up only the calx of zinc; when this is separated, the calx should again be treated either with nitrous acid, with the addition of sugar, or with the acetous acid, which will dissolve the manganese, if any; the remaining calx of iron may then be dissolved by the marine acid, and precipitated by the mineral alkali, or it may be farther calcined, and then weighed.

Zinc ores.—Take the assay weight of roasted ore, and mix it well with an eighth part of charcoal dust; put it into a strong luted earthen retort, to which must be fitted a receiver; place the retort in a furnace, and raise the fire, and continue it in a violent heat for two hours; suffer it then to cool gradually, and the zinc will be found adhering to the neck of the retort in its metallic form.

In the humid way. Distil vitriolic acid over calamine to dryness; the residuum must be lixiviated in hot water; what remains undissolved is siliceous earth; to the solution add caustic volatile alkali, which precipitates the iron and argil, but keeps the zinc in solution. The precipitate must be re-dissolved in vitriolic acid, and the iron and argil separated.

Tin ores.—Mix a quintal of tin ore, previously washed, pulverised, and roasted, till no arsenical vapor rises, with half a quintal of calcined borax, and the same quantity of pulverised pitch; these are to be put into a crucible moistened with charcoal-dust and water, and the crucible placed in an air furnace. After the pitch is burnt, give a violent heat for a quarter of an hour, and on withdrawing the crucibles the regulus will be found at the bottom. If the ore be not well washed from earthy matters, a larger quantity of borax will be requisite, with some powdered glass; and if the ore contain iron, some alkaline salt may be added.

The assay of tin ores, in the liquid way, was looked upon as impracticable, till Bergman devised the following method, which is generally successful:—Let the tin ore be well separated from its stony matrix by well washing, and then reduced to the most subtile powder; digest it in concentrated sulphuric acid, in a strong heat for several hours; then, when cooled, add a small portion of concentrated marine acid, and suffer it to stand for an hour or two; then add water, and, when the solution is clear, pour it off, and precipitate it by fixed alkali; 131 grs. of this precipitate, well washed and dried, are equivalent to 100 of tin in its reguline state, if the precipitate consist of pure tin; but, if it contain copper or iron, it must be calcined in a red heat for an hour, and then digested in nitrous acid, which will take up the copper; and afterwards in marine acid which will separate the iron.

Lead ores.—As most of the lead ores contain either sulphur or arsenic they require to be well roasted. Take a quintal of roasted ore, with the same quantity of calcined borax, half a quintal of fine powdered glass, a quarter of a quintal of pitch, and as much clean iron-filings. Line the crucible with wetted charcoal dust, and put the mixture into the crucible, and place it before the bellows of a forge-fire. When it is red-hot, raise the fire for fifteen or twenty minutes; then withdraw the crucible and break it when cold.

In the humid way. Dissolve the ore by boiling it in dilute nitrous acid; the sulphur, insoluble stony parts, and calyx of iron, will remain. The iron may be separated by digestion in the marine acid, and the sulphur by digestion, in caustic fixed alkali. The nitrous solution contains the lead and silver, which should be precipitated by the mineral fixed alkalies and the precipitate well washed in cold water, dried, and weighed. Digest it in caustic volatile alkali, which will take up the calx of silver; the residuum, being again dried and weighed, gives the proportion of the calx of lead, 132 grs. of which are equal to 100 of lead in its metallic state. The difference of weight of the precipitate, before and after the application of the volatile alkali, gives the quantity of silver, 129 grs. of which are equal to 100 of silver in its metallic state.

Copper ores.—Take an exact troy ounce of the ore, previously pulverised, and calcine it well; stir it all the time with an iron rod, without removing it from the crucible; after the calcination add an equal quantity of borax, half the quantity of fusible glass, one-fourth the quantity of pitch, and a little charcoal dust; rub the inner surface of the crucible with a paste composed of charcoal dust, a little fine powdered clay, and water. Cover the mass with common salt, and put a lid on the crucible, which is to be placed in a furnace: the fire is to be raised gradually, till it burns briskly, and the crucible continued in it for half an hour, stirring the metal frequently with an iron rod; and, when the scoria which adheres to the rod appears clear, then the crucible must be taken out, and suffered to cool; after which it must be broken, and the regulus separated and weighed; this is called black copper, to refine which equal parts of common salt and nitre are to be well mixed together. The black copper is brought into fusion, and a tea-spoonful of the flux is thrown upon it, which is repeated three or four times, when the metal is poured into an ingot mould, and the button is found to be fine copper.

In the humid way. Make a solution of vitreous copper ore, in five times its weight of concentrated vitriolic acid, and boil it to dryness; add as much water as will dissolve the vitriol thus formed; to this solution add a clean bar of iron, which will precipitate the whole of the copper in its metallic form. If the solution be contaminated with iron, the copper must be redissolved in the same manner, and precipitated again. The sulphur may be separated by filtration.

Bismuth ores.—If the ore be mineralised by sulphur, or sulphur and iron, a previous roasting will be necessary. The strong ores require no roasting, but only to be reduced to a fine powder. Take the assay weight and mix it with half the quantity of calcined borax, and the same of pounded glass; line the crucible with charcoal; melt it as quickly as possible; and, when well done, take out the crucible, and let it cool gradually. The regulus will be found at the bottom.

In the humid way. Bismuth is easily soluble in nitrous acid or aqua-regia. Its solution is colorless, and is precipitable by the addition of pure water; 118 grs. of the precipitate from nitrous acid, well washed and dried, are equal to 100 of bismuth in its metallic form.

Antimonial ores.—Take a common crucible, bore a number of small holes in the bottom, and place it in another crucible a size smaller, luting them well together; then put the proper quantity of ore in small lumps into the upper crucible, and lute thereon a cover; place these vessels on a hearth, and surround them with stone about six inches distant from them; the intermediate space must be filled with ashes, so that the undermost crucible may be covered with them; but, upon the upper, charcoal must be laid, and the whole made red-hot by the assistance of hand-bellows. The antimony being of easy fusion is separated, and runs through the holes of the upper vessel into the inferior one, where it is collected.

Humid assay of arseniated antimony. Dissolve the ore in aqua-regia, both the regulus and arsenic remain in the solution, the sulphur is separated by filtration. If the solution be boiled with twice its weight of strong nitrous acid, the regulus of antimony will be precipitated, and the arsenic converted into an acid, which may be obtained by evaporation to dryness.

Manganese ore.—The regulus is obtained by mixing the calx or ore of manganese with pitch, making it into a ball, and putting it into a crucible, lined with charcoal powder one-tenth of an inch on the sides, and one-fourth of an inch at bottom; then filling the empty space with charcoal dust, covering the crucible with another inverted and luted on, and exposing it to the strongest heat of a forge for an hour or more.

In the humid way. The ores should be first well roasted to dephlogisticate the calx of manganese and iron, if any, and then treated with nitrous acid to dissolve the earths. The residuum should now be treated with nitrous acid and sugar, by which means a colorless solution of manganese will be obtained, and likewise of the iron, if any. Precipitate with the Prussian alkali, and digest the precipitate in pure water; the prussiate of manganese will be dissolved, whilst the prussiate of iron will remain undissolved.

Arsenical ores.—This assay is made by sublimation in close vessels. Beat the ore into small pieces, and put them into a matrass, which place in a sand-pot, with a proper degree of heat; the arsenic sublimes in this operation, and adheres to the upper part of the vessel, when it must be carefully collected with a view to ascertain its weight. Sometimes a single sublimation will not be sufficient, for the arsenic in many cases will melt with the ore, and prevent its total volatilisation, in which case it is better to perform the first sublimation with a moderate heat, and afterwards bruise the remainder again, and expose it to a stronger heat.

In the humid way. Digest the ore in marine acid, adding the nitrous by degrees to help the solution. The sulphur will be found on the filter; the arsenic will remain in the solution, and may be precipitated in its metallic form by zinc, adding spirit of wine to the solution.

Nickel ore.—The ores must be well roasted to expel the sulphur and arsenic; the greener the calx proves, during this torrefaction, the more it abounds in the nickel; but the redder it is, the more iron it contains. The proper quantity of this roasted ore is fused in an open crucible, with twice or thrice its weight of black flux, and the whole covered with common salt. By exposing the crucible to the strongest heat of a forge-fire, and making the fusion complete, a regulus will be produced. This regulus is not pure, but contains a portion of arsenic, cobalt, and iron. Of the first it may be deprived by a fresh calcination, with the addition of powdered charcoal; and of the second by scorification; but it is with difficulty that it is entirely freed from the iron.

By solution in nitrous acid it is freed from its sulphur; and, by adding water to the solution, bismuth, if any, may be precipitated: as may silver, if contained in it, by the marine acid; and copper, when any, by iron.

To separate cobalt from nickel, when the cobalt is in considerable quantity, drop a saturated solution of the roasted ore in nitrous acid into liquid volatile alkali; the cobaltic part is instantly re-dissolved, and assumes a garnet color; when filtered, a gray powder remains on the filter, which is the nickel. The cobalt may be precipitated from the volatile alkali by any acid.

A brief account of the most valuable metallic alloys must close this part of our subject. We may commence with a fusible metal. 4 oz. of bismuth, $2\frac{1}{2}$ oz. of lead, and $1\frac{1}{2}$ oz. of tin. Put the bismuth into a crucible, and, when it is melted, add the lead and tin. This will form an alloy fusible at the temperature of boiling water.

1 oz. of zinc, 1 oz. of bismuth, and 1 oz. of lead. This alloy is so very fusible that it will remain in a state of fusion if put on a sheet of paper, and held over the flame of a candle or lamp.

3 parts of lead, 2 parts of tin, and 5 parts of

bismuth, will form an alloy fusible at 197° Fahrenheit, peculiarly applicable to casting, or the taking of impressions from gems, seals, &c. In making casts with this and similar alloys, it is necessary to use the metal at as low a temperature as possible; otherwise, the water adhering to the things from which the casts are to be taken, forms vapor, and produces bubbles. The fused metal should be poured into a tea-cup, and allowed to cool, till just ready to set at the edges, when it must be poured into the mould. In taking impressions from gems, seals, &c., the fused alloy should be placed on paper or pasteboard, and stirred about till it has, by cooling, attained the consistence of paste, at which moment the die, gem, or seal, should be stamped on it, and a very sharp impression will then be obtained.

Bath metal is a mixture of 4½ oz. of zinc, with 1 lb. of brass.

Brass is composed of 4½ lbs. of copper, and 1½ lb. of zinc. But brass that is to be cast into plates, from which pans and kettles are to be made, and wire that is to be drawn, must, instead of using the zinc in a pure state, be composed of 56 lbs. of the finest calamine, or ore of zinc, and 34 lbs. of copper.

Old brass, which has frequently been exposed to the action of fire, when mixed with the copper and calamine, renders the brass far more ductile, and fitter for the making of fine wire, than it would be without it; but the German brass, particularly that of Nuremberg, is, when drawn into wire, said to be far preferable to any made in England for the strings of musical instruments.

Pinchbeck. 5 oz. of pure copper, and 1 oz. of zinc. The zinc must not be added till the copper is in a state of fusion. Some use only half this quantity of zinc, in which proportion the alloy is more easily worked, especially in the making of jewellery. Or 1 oz. of brass, and 2 oz. of copper, fused together under a coal of charcoal dust.

Prince's metal. 3 oz. of copper, and 1 oz. of zinc; or 8 oz. of brass, and 1 oz. of zinc. Or 4 oz. of copper, and 2 oz. of zinc. In this last the copper must be fused before the zinc is added. When they have combined, a very beautiful and useful alloy is formed, called prince Rupert's metal.

Bell-metal. 6 parts of copper, and 2 parts of tin. These proportions are the most approved, for bells, throughout Europe, and in China. In the union of the two metals the combination is so complete, that the specific gravity of the alloy is greater than that of the two metals in an uncombined state. Or 10 parts of copper, and 2 parts of tin. It may, in general, be observed, that a less proportion of tin is used for making church-bells than clock-bells: and that a little zinc is added for the bells of repeating-watches, and other small bells.

Tutania, or Britannia-metal. 4 oz. of plate brass, and 4 oz. of tin; when in fusion add 4 oz. of bismuth, and 4 oz. of regulus of antimony. This is the composition, or hardening, that is to be added at discretion to melted tin, until it has acquired the requisite degree of color and hardness; or melt together 2 lbs. of plate brass, 2 lbs. of tin, 2 lbs. of bismuth, 2 lbs. of regulus of antimony, 2 lbs. of a mixture of copper and arsenic, either by cementation or melting. This composition is to be added at discretion to melted tin; or 1 lb. of copper, 1 lb. of tin, and 2 lbs. of regulus of antimony, with or without a little bismuth; or 8 oz. of shruff brass, 2 lbs. of regulus of antimony, and 10 lbs. of tin.

German tutania. 2 drachms of copper, 1 oz. regulus of antimony, and 3 oz. of nitre.

Spanish tutania, 8 oz. of scrap-iron or steel, 1 lb. of antimony, and 3 oz. of nitre. The iron or steel must be heated to a white heat, and the antimony and nitre must be added in small portions. Melt and harden 1 lb. of tin with 2 oz. of this compound. Or melt together 4 oz. of antimony, 1 oz. of arsenic, and 2 lbs. of tin. The first of these Spanish alloys would be a beautiful metal if arsenic were added.

Engestroom tutania. 4 parts copper, 8 parts regulus of antimony, and 1 part bismuth. When added to 100 parts of tin, this compound will be ready for use.

Queen's metal. 4½ lbs. of tin, ½ lb. of bismuth, ½ lb. antimony, and ½ lb. lead. This alloy is used for the making of tea-pots, and other vessels, which are required to imitate silver. Or 100 lb. of tin, 8 lbs. regulus of antimony, 1 lb. bismuth, and 4lbs. copper.

White metal. 10 oz. of lead, 6 oz. of bismuth, and 4 drachms of regulus of antimony. Or 2 lbs. of regulus of antimony, 8 oz. of brass, and 10 oz. of tin.

Common hard white metal. 1 lb. of brass, 1½ oz. of zinc, and ½ oz. of tin.

Tombac. 16 lbs. of copper, 1lb. of tin, and 1 lb. of zinc.

Red tombac. 5½ lbs. of copper, and ½ lb. of zinc. The copper must be fused in the crucible before the zinc is added. This alloy is of a reddish color, and possesses more lustre, and is of greater durability than copper.

White tombac, copper, and arsenic, put together in a crucible and melted, covering the surface with muriate of soda, to prevent oxidation, will form a white brittle alloy.

Gun metal. 112 lbs. of Bristol brass, 14 lbs. zinc, and 7 lbs. block tin. Or 9 parts copper, and 1 part tin. The above compounds are those used in the manufacture of small and great brass guns, swivels, &c.

Blanched copper. 8 oz. of copper, and ½ oz. of neutral arsenical salt, fused together, under a flux composed of calcined borax, charcoal dust, and fine powder glass.

Specula of telescopes. 7 lbs. of copper, and when fused, add 3lbs. of zinc, and 4 lbs. of tin. These metals will combine and form a beautiful alloy of great lustre, and of a light yellow color, fitted to be made into specula for telescopes. Mr. Mudge used only copper and grain-tin, in the proportion of 2 lbs. to 14½ oz.

Kustitian's metal for tinning. To 1 lb. of malleable iron, at a white heat, add 5 oz. of regulus of antimony, and 24 lb. of the purest Molucca tin. This alloy polishes without the blue tint, and is free from lead or arsenic.

Metal for flute-key valves. 4 oz. of lead, and 5 oz. of antimony, fused in a crucible, and cast into a bar, forms an alloy of considerable hard

ness and lustre. It is used by flute manufacturers (when turned into small buttons in a lathe) for making valves to stop the key-holes of flutes.

Printers' types. 10 lbs. of lead, and 2 lbs. of antimony. The antimony must be thrown into the crucible when the lead is in a state of fusion. The antimony gives a hardness to the lead, without which the type would speedily be rendered useless in a printing-press. Different proportions of lead, copper, brass, and antimony, frequently constitute this metal. Every artist has his own proportions, so that the same composition cannot be obtained from different foundries; each boasts of the superiority of his own mixture.

Small types and stereotype plates. 9 lbs. of lead, and when melted, add 2 lbs. of antimony, and 1 lb. of bismuth. This alloy expands as it cools, and is therefore well suited for the formation of small printing types (particularly when many are cast together to form stereotype plates), as the whole of the mould is accurately filled with the alloy; consequently there can be no blemish in the letters. Or 8 parts lead, 2 parts antimony, and ½ part tin.

Common pewter. 7 lbs. of tin, 1 lb. of lead, 6 oz. of copper, and 2 oz. of zinc. The copper must be fused before the other ingredients are added. This combination of metals will form an alloy of great durability and tenacity; also of considerable lustre.

Best pewter. 100 parts tin, and 17 parts regulus of antimony.

Hard pewter. 12 lbs. of tin, 1 lb. regulus of antimony, and 4 oz. of copper.

Common solder. 2 lbs. of lead, and 1 lb. of tin. The lead must be melted before the tin is added. This alloy, when heated by a hot iron, and applied to the tinned iron with powdered rosin, acts as a cement or solder; it is also used to join lead pipes, &c.

Soft solder. 2 lbs. of tin, and 1 lb. of lead.

Solder for steel joints. 19 dwts. of fine silver, 1 dwt. copper, and 2 dwts. of brass, melted together under a coal of charcoal dust. This solder possesses several advantages over the usual zinc soda or brass, when employed in soldering cast steel, &c., as it fuses with less heat, and its whiteness has a better appearance than brass.

Silver solder for jewellers. 19 dwts. of fine silver, 1 dwt. copper, and 10 dwts. brass.

Silver solder for plating. 10 dwts. brass, and 1 oz. pure silver.

Gold solder. 12 dwts. of pure gold, 2 dwts. pure silver, and 4 dwts. copper.

Brass solder for iron. Thin plates of brass are to be melted between the pieces that are to be jointed. If the work be very fine, as when two leaves of a broken saw are to be brazed together, cover it with pulverised borax, melted with water, that it may incorporate with the brass powder which is added to it; the piece must be then exposed to the fire, without touching the coals, and heated till the brass is seen to run.

Bronze. 7 lbs. pure copper, 3 lbs. zinc, and 2 lbs. tin. The copper must be fused before the other ingredients are added. These metals, when combined, form the bronze, so much used both in ancient and modern times, in the formation of busts, medals, and statues.

According to Pliny, the metal used by the Romans for their statues, and for the plates on which they engraved inscriptions, was composed in the following manner:—They first melted a quantity of copper, into which they put one-third of its weight of old copper which had been long in use; to every 100lbs. weight of this mixture they added 12½ lbs. of an alloy, composed of equal parts of lead and tin.

Mock platina. Melt together 8 oz. of brass, and 5 oz. of zinc.

Useful alloy of gold with platinum. 7½ dr. pure gold, and ½ dr. platinum. The platinum must be added when the gold is perfectly melted. The two metals will combine intimately, forming an alloy rather whiter than pure gold, but remarkably ductile and elastic; it is also less perishable than pure gold, or jewellers' gold; but more readily fusible than that metal. These excellent qualities must render this alloy an object of great interest to workers in metals. For springs, where steel cannot be used, it will prove exceedingly advantageous. It is a curious circumstance that the alloy of gold and platinum is soluble in nitric acid, which does not act on either of the metals in a separate state. It is remarkable, too, that the alloy has very nearly the color of platinum, even when composed of eleven parts of gold to one of the former metal.

Ring gold. 6 dwts. 12 grs. Spanish copper, 3 dwts. 16 grs. fine silver, and 1 oz. gold coin.

Gold from 35s. to 40s. per ounce. 8 oz. 8 dwts. Spanish copper, 10 dwts. fine silver, and 1 oz. gold coin.

Manheim gold, or similor. 3¾ oz. copper, 1½ oz. of brass, and 15 grs. of pure tin.

Gliding metal. 4 parts of copper, 1 part of Bristol old brass, and 14 oz. of tin to every pound of copper.

For common jewellery. 3 parts of Copper, 1 part of Bristol old brass, and 4 oz. of tin to every pound of copper. If this alloy is for fine polishing, the tin may be omitted, and a mixture of antimony and lead substituted. Paler polishing metal is made by reducing the copper to two or to one part.

Yellow dipping metal. 2 parts of cheadle brass, 1 part of copper, with a little Bristol old brass, and ½ oz. of tin to every pound of copper. This alloy is almost of the color of gold coin. Cheadle brass is the darkest, and gives the metal a greenish hue. Old Bristol brass is pale and yellow. Or 1 lb. of copper, and 5 oz. of zinc. The copper should be tough cake, and not tile. When antimony is used, instead of tin, it should be in smaller quantity, or the metal will be brittle.

Imitation of silver. ¾ oz. of tin, and 1 lb. of copper, will make a pale bell-metal, which will roll and ring very near to sterling silver.

Of casting.—The casting of metal, after its preparation from the ore, is a most important part of the science of metallurgy.

The art of founding in metal, or casting, now occupies a space in our wants, which entitles it to considerable attention. If the Greeks, and after them the Romans, perfected it in as far as refers to the casting in brass and bronze, we have extended it more than they did, inasmuch as we have turned it to all the great features of general utility. Iron constitutes the grand staple in modern founding. See IRON MANUFACTURE.

The great abundance of this metal, with its consequent cheapness, together with the developments of chemistry, has, amongst us, opened to it a field, and created for it a demand, by which its operations may go on ad infinitum, and it is hoped with a success commensurate.

For composition of brass, see CHEMISTRY

The casting figures in brass is not much practised among the moderns at this time, although it was a good deal followed at the restoration of the arts in the fifteenth century. At that time brass works were had recourse to in the decoration of most buildings of any consideration; and, in order to supply the metal at little cost, several of the ancient edifices then existing were mutilated for the purpose. In Rome many of the vaultings to the temples were ornamented by having their lacunaria relieved by pateras and other decorations of brass or silver; these the popes of the times removed to compose the childish ornaments for their then erecting or newly consecrated Catholic churches. France, Germany, and England, at that time subject to the same caprice in religion as well as in the arts, adopted a similar style of decoration in their religious edifices, as numerous reliques still existing in tombs, shrines, screens, and other parts of their cathedrals and religious houses fully demonstrate. Amongst us certainly, and particularly after Henry VIII.'s separation from the church of Rome, such works were discontinued as Catholic and idolatrous. Elizabeth, proceeding in the reformation already commenced by her predecessor, not only destroyed the images, but the pictures also; and at the same time strictly forbad any thing of the kind to be admitted in future under the severest penalties. The rebellion in 1648, completed what the Reformation had begun. The fanatics of this time defaced whatever they could get at, that the former inquisition had spared; they tore down the brass from the monuments and screens, carried away the plate from the altars, broke the painted windows, and dilapidated the tombs of the saints, crying out in their work of spoliation, 'cursed be he that doeth the work of the Lord deceitfully.' After this, it would be vain to look in England for works in brass of any consideration, as little was spared but what was too remote for the Vandals of that period to get at. From this time, among us, a void or chaos existed and continued to exist in works of art, till a more enlightened policy began to blend itself, which happened about the close of the seventeenth century. But the effects of the persecution had been felt so much that the liberal arts had lost their practisers; hence the introduction of foreigners, and the consequent notion about our inability in works of taste; which is much too insipid and ridiculous at this time to need refutation.

We conclude with an account of our principal metalline exports, TIN, and COPPER :—

	Counties to which Exported.	Quantity of Tin Exported.	
		British Tin.	Foreign Tin.
		Cwts. qrs. lbs.	Cwts. qrs. lbs.
Europe, exclusive of Ireland.	Russia	4,194 0 0	348 3 20
	Sweden	488 2 8	
	Norway	15 2 3	
	Denmark	34 0 16	
	Prussia	419 2 0	
	Germany	390 2 0	
	Holland	2,500 1 1	
	Flanders	321 2 12	
	France	14,651 3 13	3,609 2 24
	Portugal, Azores, and Madeira	399 0 0	
	Spain and the Canaries	473 0 0	
	Gibraltar	52 1 0	
	Italy	4,636 1 19	176 1 5
	Malta	100 0 0	
	Ionian Islands	20 0 0	
	Turkey and the Levant	2,592 0 0	
	Isles Guernsey and Jersey	53 3 0	
		31,342 1 16	4,134 3 21
Asia		29 1 0	
America, viz.—			
	British colonies in North America	32 0 0	
	British West Indies	195 0 22	
	United States	992 0 21	574 3 18
	Brazil	98 0 7	
	Mexico	6 0 0	
	Colombia	20 0 0	
	Peru	9 2 0	
	Buenos Ayres	8 0 0	
Total, exclusive of Ireland		32,732 2 10	4,709 3 11
Ireland		1,505 1 9	
Total to all parts		34,237 3 19	4,709 3 11

The Value of the METALLINE BODIES, as an article of Trade to GREAT BRITAIN, particularly appears from the following Account of the Amount of Exportation of COPPER, in the Year ending 5th of January, 1826.

Ports from which Exported.	BRITISH COPPER EXPORTED.						FOREIGN COPPER EXPORTED.		
	Unwrought in Bricks, Pigs, &c.	Coin.	Sheets, Nails, &c.	Wire.	Wrought Copper of all other Sorts.	Total of British Copper Exported.	Unwrought in Bricks, Pigs, &c.	Wrought in Sheets and Bars.	Old, for re-manufacture.
	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.
London		2,099 1 9	27,294 3 27	38 1 10	17,316 3 13	46,749 2 3	4,605 1 24	644 2 19	
Dover					13 0 0	13 0 0			
Portsmouth			23 1 10		67 2 3	90 3 13			
Southampton			575 2 0	1 2 0	8 3 0	585 3 0			
Poole			3 0 10		1 3 8	4 3 18			
Weymouth					0 3 0	0 3 0			
Dartmouth					8 1 14	8 1 14			
Plymouth			13 1 24		18 2 0	31 3 24			
Biddeford			35 0 0			35 0 0			
Bristol			2,441 2 23	0 1 0	3,362 3 24	5,804 3 19			
Swansea		2 3 7	290 0 14		64 2 22	357 2 15			
Liverpool	10 0 0	30 0 0	20,249 0 0		2,999 0 21	23,288 0 21			41 0 3
Whitehaven			17 2 12		22 1 7	39 3 19			
Newcastle			1 2 17		37 2 10	39 0 27			
Sunderland			5 0 0			5 0 0			
Hull			46 0 0			46 0 0			
Harwich			1 2 18			1 2 18			
Glasgow, Greenock, &c.		2 0 0	439 2 0		1,080 1 16	1,521 3 16			
Total	10 0 0	2,134 0 16	51,437 2 15	40 0 10	25,003 2 26	78,624 2 11	4,605 1 24	644 2 19	41 0 3

Countries to which exported.	British Copper Exported. Unwrought in Bricks, Pigs, &c.	Coin.	Sheets, Nails, &c.	Wire.	Wrought Copper of all other sorts.	Total of British Copper Exported.	Foreign Copper Exported. Unwrought in Bricks, Pigs, &c.	Wrought in Sheets and Bars.	Old, for remanufacture.
	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts q. lbs.	Cwts. q. lbs.
Europe, exclusive of Ireland. Russia	. .	. . .	. . .	3 1 4	. . .	3 1 4			
Sweden	. .	. . .	126 0 0	. .	11 0 0	137 0 0			
Norway	. .	. . .	1 2 17	. .	. . .	1 2 17			
Denmark	. .	. . .	506 0 1	. .	. . .	506 0 1			
Prussia	. .	. . .	. . .	6 1 0	0 2 0	6 3 0			
Germany	. .	. . .	624 3 17	. .	192 0 13	817 0 2			
Holland	. .	. . .	5,822 0 21	1 3 19	1,839 2 15	7,663 2 27	787 1 3		
Flanders	. .	30 0 0	1,111 0 25	. .	127 3 22	1,269 0 19	120 2 5		
France	. .	. . .	36 0 0	. .	170 3 20	206 3 20			
Portugal, Azores, and Madeira	. .	. . .	923 3 20	2 0 8	727 2 15	1,653 2 15			
Spain and the Canaries	. .	. . .	82 3 0	3 2 0	69 2 24	155 3 24	3,079 3 5		
Gibraltar	. .	. . .	317 1 8	. .	279 2 2	596 3 10			
Italy	. .	. . .	498 0 25	. .	46 1 0	544 1 25			
Malta	. .	. . .	4 0 0	. .	8 3 0	12 3 0			
Ionian Islands	. .	. . .	. . .	. .	8 0 0	8 0 0			
Turkey and the Levant	. .	. . .	. . .	. .	9 2 0	9 2 0			
Isle of Man	. .	. . .	3 0 22	. .	72 2 16	75 3 10			
Isles Guernsey, Jersey, and Alderney.	. .	. . .	1,170 0 15	1 2 0	175 3 26	1,347 2 13			
		30 0 0	11,227 2 3	18 2 3	3,740 0 13	15,016 0 19	3,987 2 13		

Countries to which Exported.	British Copper Exported.						Foreign Copper Exported.		
	Unwrought in Bricks, Pigs, &c.	Coin.	Sheets, Nails, &c.	Wire.	Wrought Copper of all other sorts.	Total of British Copper Exported.	Unwrought in Bricks, Pigs, &c.	Wrought in Sheets and Bars.	Old for re-manufacture.
	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.	Cwts. q. lbs.
Total from last page	. .	30 0 0	11,227 2 3	18 2 3	3,740 0 13	15,016 0 19	3,987 2 13		
Asia	. .	1,288 1 9	6,870 0 21	13 0 0	2,646 0 11	10,817 2 13	. . .	644 2 19	
Africa	. .	. . .	166 1 27	5 0 0	237 2 0	408 3 27			
America, viz.									
British Colonies in North America	. .	. . .	3,509 3 15	. .	2,315 2 9	5,825 1 24			
British West Indies	. .	. . .	1,590 3 16	2 1 0	4,942 3 23	6,536 0 11			
Foreign West Indies	. .	. . .	479 0 6	. .	224 0 8	703 0 14			
United States	10 0 0	. . .	15,448 3 27	. .	4,370 0 10	19,829 0 9	617 3 11	. . .	41 0 3
Brasil	. .	. . .	9,018 2 17	. .	3,694 2 18	12,713 1 7			
Mexico	. .	. . .	55 0 0	. .	79 0 0	134 0 0			
Colombia	. .	. . .	30 0 0	. .	13 0 0	43 0 0			
Peru	. .	. . .	7 2 0	. .	92 2 0	100 0 0			
Chili	. .	. . .	42 0 0	. .	25 0 0	67 0 0			
Buenos Ayres	. .	531 0 0	61 3 0	. .	11 1 24	604 0 24			
Total, exclusive of Ireland	10 0 0	1,849 1 9	48,507 3 20	38 3 3	22,392 0 4	72,798 0 8	4,605 1 24	644 2 19	41 0 3
Ireland	. .	284 3 7	2,929 2 23	1 1 7	2,610 2 22	5,826 2 3			
Total to all parts	10 0 0	2,134 0 16	51,437 2 15	40 0 10	25,002 2 26	78,624 2 11	4,605 1 24	644 2 19	41 0 3

METAMOR'PHOSE, *v. a.* } Fr. *metamorphoser*; Gr. *μεταμορφοω*. To change the form of a thing: transformation.
METAMOR'PHOSIS, *n. s.* }

Thou Julia, thou hast *metamorphosed* me;
Made me neglect my studies, lose my time.
Shakspeare.

They became degenerate and *metamorphosed* like Nebuchadnezzar, who, though he had the face of a man, had the heart of a beast. *Davies on Ireland.*

His whole oration stood upon a short narration, what was the causer of this *metamorphosis*. *Sidney.*

Obscene talk is grown so common, that one would think we were fallen into an age of *metamorphosis*, and that the brutes did not only poetically, but really speak. *Government of the Tongue.*

From such rude principles our form began,
And earth was *metamorphosed* into man. *Dryden.*

What! my noble colonel in *metamorphosis*? On what occasion are you transformed? *Id.*

Cowardice may be *metamorphosed* into prudence; intemperance into good-nature and good fellowship. *Pope.*

There are probable machines in epic poems, where the gods are no less actors than the men; but the less credible sort, such as *metamorphoses*, are far more rare. *Broome.*

METAMORPHOSIS is used for the mythological changes related by the ancient poets; upon which Ovid wrote fifteen books. Mythological metamorphoses were held to be of two kinds, apparent and real; thus that of Jupiter into a bull was only apparent; whereas that of Lycaon into a wolf was supposed to be real. Most of the ancient metamorphoses include some allegorical meaning, relating either to physics or morality: some authors are even of opinion that a great part of the ancient philosophy is couched under them; and lord Verulam and Dr. Hooke have attempted to unriddle several of them.

MET'APHOR, *n. s.* } Fr. *metaphore*; Gr. *μεταφορα*; *μετα*, trans, and *φερω*, I bear or carry. A trope or figure of speech whereby a word is applied to a use to which, in its original import, it cannot be put; or, as Dr. Johnson says, it is a simile comprised in a word.
METAPHOR'ICAL, *adj.* }
METAPHOR'IC. }

The words which were, do continue; the only difference is, that, whereas before they had a literal, they now have a *metaphorical* use. *Hooker.*

Some of the best interpreters therefore have taken this *metaphor* of light to imply the purity and perfect goodness of God. *Bp. Hall.*

The work of tragedy is on the passions, and in a dialogue; both of them abhor strong *metaphors*, in which the epopœa delights. *Dryden.*

The *metaphor* of laughing, applied to fields and meadows when they are in flower, or trees when they are in blossom, runs through all languages, which I have not observed of any other *metaphor*, excepting that of fire and burning when they are applied to love. *Addison.*

One died in *metaphor*, and one in song. *Pope.*

METAPHOR, in poetry. A metaphor differs from a simile in form only, not in substance: in a simile the two subjects are kept distinct in the expression, as well as in the thought; in a metaphor the two subjects are kept distinct in the thought only, not in the expression. For example, Homer compares a hero to a lion, and describes all the qualities of a lion that resemble those of the hero. The fundamental pleasure here, that of resemblance, belongs to the thought. An additional pleasure arises from the expression: the poet, by figuring his hero to be a lion, goes on to describe the lion in appearance, but in reality the hero; and his description is peculiarly beautiful, by expressing the virtues and qualities of the hero in new terms, which, properly speaking, belong not to him but to the lion. An allegory differs from a metaphor; and a figure of speech differs from both. A metaphor is an act of the imagination, figuring one thing to be another. An allegory requires no such operation, nor is one thing figured to be another: it consists in choosing a subject having properties or circumstances resembling those of the principal subject; and the former is described in such a manner as to represent the latter. The subject thus represented is kept out of view: we are left to discover it by reflection; and we are pleased with the discovery because it is our own work. In a figure of speech there is no fiction of the imagination employed, as in a metaphor; nor a representative subject introduced, as in an allegory. This figure, as its name implies, regards the expression only, not the thought; and it may be defined, the using a word in a sense different from what is proper to it. Thus youth, or the beginning of life, is expressed figuratively by the morning of life: morning is the beginning of the day; and in that view it is employed to signify the beginning of any other series, life especially, the progress of which is reckoned by days. The following particular rules, however, may here be laid down, as proper to be observed respecting metaphors:—No comparison ought to be made where the resemblance is either too strong or too faint. A metaphor, above all, ought to be short: it is difficult, for any time, to suppose a lively image of a thing to be what we know it is not; and, for that reason, a metaphor drawn out to any length, instead of illustrating or enlivening the principal subject, becomes disagreeable by overstraining the mind. In constructing a metaphor the writer ought to use such words only as are applicable literally to the imagined nature of his subject: figurative words ought carefully to be avoided; for such complicated figures, instead of setting the principal subject in a strong light, involve it in a cloud. The jumbling different metaphors in the same sentence, beginning with one metaphor and ending with another, commonly called a mixed metaphor, ought never to be indulged. It is improper to join different metaphors in the same period, even where they are preserved distinct; for, when the subject is imagined to be first one thing and then another, in the same period, without interval, the mind is distracted by the rapid transition. It is still worse to jumble together metaphorical and natural expression, so as that the period must be understood in part metaphorically, in part literally; for the imagination cannot follow, with sufficient ease, changes so sudden and unprepared.

MET'APHRASE, *n. s.* } Gr. *μεταφρασις*. A verbal translation from one language into another: a literal translator.
METAPHR'ASER, }

This translation is not so loose as paraphrase, nor so close as *metaphrase*. *Dryden.*

METAPHYSICS.

METAPHYSIC, *n. s.* ⎫ Fr. *metaphysique;*
METAPHYS'ICS, ⎬ Gr. *μεταφυσικη*. On-
METAPHYS'ICAL, *adj.* ⎬ tology; the doctrine
METAPHYSIC'IAN, *n. s.* ⎭ of the general affections of being: a term first used by Aristotle. See below. Metaphysical is used by Shakspeare for supernatural: a metaphysician is a person skilled in, or a student of, metaphysics.

Hie thee hither,
To chastise with the valour of my tongue
All that impedes thee from the golden round,
Which fate, and *metaphysical* aid, doth seem
To have crowned thee withal.
Shakspeare. Macbeth.

The mathematicks and the *metaphysicks*,
Fall to them as you find your stomach serves you.
Shakspeare.

Wherein the philosopher, and the superstitiously ignorant, are contrarily extreme: while the one seeks out natural causes of God's immediate and *metaphysical* works, the other ascribes ordinary effects to supernatural causes. *Bp. Hall.*

If sight be caused by intromission, or receiving in, the form of contrary species should be received confusedly together, which, how absurd it is, Aristotle shews in his *metaphysicks*. *Peacham.*

Call her the *metaphysicks* of her sex,
And say she tortures wits as quartans vex
Physicians. *Cleaveland.*

The *metaphysick's* but a puppet motion
That goes with screws, the notion of a notion,
The copy of a copy, and lame draught
Unnaturally taken from a thought. *Hudibras.*

See physick beg the Stagyrite's defence!
See *metaphysick* call for aid on sense!
Pope's Dunciad.

The topics of ontology, or *metaphysick*, are cause, effect, action, passion, identity, opposition, subject, adjunct, and sign. *Watts's Logick.*

METAPHYSICS. This term literally means after physics, and originated with Aristotle. After treating of physics, or rather what we should term natural history, he begins his next book with the Greek words *μετα τα φυσικα*, which we have joined together as one word—metaphysics. In the treatise of Aristotle, to which the above words are prefixed, he pretends to go beyond physics, to elevate the mind above corporeal objects, to fix it on the contemplation of spiritual things, and to enable it to judge of the principles of science by abstraction. The metaphysics of Aristotle were long a principal part of the learning of the schools, in which confusion was worse confounded. Johnson remarks, in his apposite manner, that what reason did not dictate, reason cannot explain; and this remark will apply in all its force to many unmeaning or absurd modes of expression. If we were at liberty to follow our own choice, we would rather discard the term metaphysics than attempt a definition of it. It is no longer the symbol of the absurdities that were formerly very gravely treated of under the imposing names of ontology and pneumatology; but it is yet so worthy of its origin and particular appropriation, that scarcely any two writers can be found who would agree respecting its import.

But, without attempting to define what is or what ought to be the import of the term, we purpose to give a brief view of the most distinguished metaphysical writers, from the period when the authority of Aristotle was shaken off, down to the present time; and to attempt an estimate of the reality and value of metaphysical knowledge.

What may be designated the modern metaphysics cannot be traced back farther than the fifteenth century,—that memorable period when an extraordinary impulse was given in Europe to the human mind, and commonly called the revival of learning. Down to that time, through the whole of the middle or dark ages, the doctrines of Aristotle were not only blindly received, but it was considered a kind of blasphemy to call them in question. There was now at last, however, a mental revolution, attended with extraordinary freedom and boldness towards received opinions and established authorities. Luther, the father of the Protestant Reformation, expresses himself with much decision concerning the futility of the Aristotelian doctrines. 'What does it contribute,' he asks, 'to the knowledge of things, to trifle and cavil in words conceived and prescribed by Aristotle concerning matter, form, motion, and time?' Nihil adjumenti ex ipso haberi posse non solùm ad theologiam seu sacras literas, verùm etiam ad ipsam naturalem philosophiam. Quid enim juvet ad rerum cognitionem, si de materiâ, formâ, motu, tempore, nugari et cavallari queas verbis ab Aristotele conceptis et præscriptis. The following passage to the same purpose is quoted by Bayle, article Luther, note H. H.: 'You will not persuade me that philosophy is that garrulity concerning matter, motion, infinity, place, vacuum, time:—things that we learn almost wholly from Aristotle, which avail nothing to the intellect, the affections, or moral conduct of men, but which are fit only to sow and spread contentions.' Non mihi persuadebitis, philosophiam esse garrulitatem illam de materiâ, formâ, motu, infinito, loco, vacuo, tempore, quæ ferè in Aristotele sola discimus, talia quæ nec intellectum, nec affectum, nec communes hominum mores quidquam juvent; tantùm contentionibus serendis seminandisque idonea. In another of the extracts made by Boyle from Luther, the latter says that he was very desirous if he had leisure of exposing the quackery of Aristotle. In his Colloquia Mensalia we are told that 'he hated Aristotle, and called the schoolmen sophistical locusts, caterpillars, frogs, and lice.' See *Jortin's Life of Erasmus.*

It cannot be fairly said that Luther affected to hate or despise what he would not be at the trouble of learning; for, according to the testimony of Melancthon and other competent witnesses, he possessed much mastery in scholastic learning, and was a strenuous partisan of the sect of Nominalists, or Terminists, concerning which some notice will be taken in a subsequent part. The opinion of Luther, so freely and boldly expressed, must have had much influence in bringing the scholastic metaphysics into neglect

and contempt among the Protestants. In this indeed, as in other important respects, the energy of the great reformer was counteracted by Melancthon, who favored to the utmost of his ability the Peripatetic jargon. 'The preservation of the Aristotelian philosophy in the Protestant colleges was chiefly owing to Melancthon, who wrote abridgments of most of its doctrines, which long prevailed in them. Et Melancthoni quidem præcipuè debetur conservatio philosophiæ Aristotelicæ in academiis Protestantium. Scripsit is compendia plerarumque disciplinarum philosophiæ Aristotelicæ, quæ in academiis diu regnârunt. Heineccii, Elem. Hist. Phil.

Another person who contributed not a little towards throwing off the yoke of the old philosophy, and establishing that intellectual independence which now began to display itself in several parts of Europe, was the famous or notorious Paracelsus. This daring innovator, who had so little reverence for antiquity that he would have made a bonfire of the writings of Aristotle, Hippocrates, and all the other old authors of any intellectual authority, was born at Einfidelen, Switzerland, in 1493, and was consequently ten years younger than Luther. Le Clerc, having quoted from Paracelsus the expression which designates the philosophy of Aristotle 'a wooden foundation,' adds, 'He ought to have attempted to lay a better; but, if he has not done this, he has at least, by discovering its weakness, invited his successors to look out for a firmer basis.'

A much better and more permanently influential man than Paracelsus was Ramus, born at Cuth in Picardy in 1515. He received his education in the college of Navarre, and his thesis on being admitted to the degree of M. A. was an attack on the doctrine of Aristotle; which occasioned a violent controversy, in consequence of which Ramus was prohibited from teaching; but he was in 1551 nominated to the regius professorship in the university of Paris, where he opposed Aristotle with invincible courage. The bold and persevering spirit with which Ramus, remarks Mr. Stewart, disputed in the university of Paris the authority of Aristotle, and the persecutions he incurred by this philosophical heresy, entitle him to an honorable distinction from the rest of his brethren. He was certainly a man of uncommon acuteness as well as eloquence, and placed in a very strong light some of the most vulnerable parts of the Aristotelian logic; without, however, exhibiting any marks of that deep sagacity which afterwards enabled Bacon, Descartes, and Locke, to strike at the very root of the system. His copious and not inelegant style as a writer recommended his innovations to those who were disgusted with the barbarism of the schools; while his avowed partiality for the reformed faith (to which he fell a martyr in the massacre of Paris) procured many proselytes to his opinions in all the Protestant countries of Europe. In England his logic had the honor, in an age of comparative light and refinement, to find an expounder and methodiser in the author of Paradise Lost; and in some of our northern universities, where it was very early introduced, it maintained its ground till it was supplanted by the logic of Locke. It has been justly said of Ramus, that, 'although he had a genius sufficient to shake the Aristotelian fabric, he was unable to substitute any thing more solid in its place;' but it ought not to be forgotten that even this praise, scanty as it may now appear, involves a large tribute to his merits as a philosophical reformer. Before human reason was able to advance, it was necessary that it should first be released from the weight of its fetters.'

How far human reason has been able to advance, in the metaphysical regions, we shall endeavour to ascertain in the proper place. It is certainly no small part of the merit of Ramus that he did not attempt to substitute any thing of his own for much that he objected to in Aristotle, whose chief folly, as well as that of many other metaphysicians, both before and after him, was in doing any thing whatever of the kind which he attempted. When men raise questions unsusceptible of solution, all that they can possibly write concerning them must be of the nature of a literary nuisance; and he performs the greatest service to the world who demolishes the babel-building and clears the whole away. It is said, by Montesquieu, that the only good book which the Spaniards have is the one which exposes the absurdity of all the rest. And we shall find, perhaps, that the best part of the best metaphysical book yet in existence is of this description.

Next in the order of time among the demolishers of the Aristotelian philosophy, but superior to all the others in intellectual power, stands the great lord Bacon, justly designated the father of experimental philosophy. It would now be idle to indulge in eulogial strains on the intellectual character of the author of Novum Organon. That he was a determined enemy to the sophistry and absurdity of the schools which had been so long dignified with the name of philosophy, and that he embraced every opportunity of exposing them, is well known to all who are acquainted with his writings. It is probable that the decided manner in which he expressed his opinion did more towards the exploding of the old philosophy than had been effected by the efforts of Luther, Paracelsus, Ramus, and all his predecessors, who aimed at its subversion. We must not forget, however, that, according to his own memorable words, 'time is the greatest of all innovators.' We are apt to ascribe too much to particular persons, and too little to the intellectual state of the world at the time when they appeared. There is no doubt, for instance, that Luther exerted a mighty influence on the opinions of his contemporaries; yet he is perhaps rather to be considered as the son than the father of the Reformation. So in reference to the school philosophy—its overthrow was owing to the progress of general knowledge in the slow course of time, rather than to any sudden creation of gigantic genius or influential intellect. The simultaneous attacks upon Aristotle in so many remote parts of Europe, in Germany, Italy, Switzerland, France, and England, proves that the general mind was now prepared to throw off the yoke.

'The merits of Bacon,' remarks Mr. Stewart, 'as the father of experimental philosophy, are so universally acknowledged, that it would be

superfluous to touch upon them here. The lights which he has struck out in various branches of the philosophy of mind have been much less attended to; although the whole scope and tenor of his speculations show that to this study his genius was far more strongly and happily turned than to that of the material world. It was not, as some seem to have imagined, by sagacious anticipations of particular discoveries afterwards to be made in physics, that his writings have had so powerful an influence in accelerating the advancement of that science. In the extent and accuracy of his physical knowledge he was inferior to many of his predecessors; but he surpassed them all in his knowledge of the laws, the resources, and the limits of the human understanding. The sanguine expectations with which he looked forwards to the future were founded solely on his confidence in the untried capacities of the mind; and on a conviction of the possibility of invigorating and guiding, by means of logical rules, those faculties which, in all our researches after truth, are the organs or instruments to be employed.

'Nor is it merely as a logician that Bacon is entitled to notice on the present occasion. It would be difficult to name another writer prior to Locke, whose works are enriched with so many just observations on the intellectual phenomena. Among these the most valuable relate to the laws of memory and of imagination; the latter of which subjects he seems to have studied with peculiar care. In one short and beautiful paragraph concerning Poetry, under which title may be comprehended all the various creations of this faculty, he has exhausted every thing that philosophy and good sense have ever yet had to offer, on what has been since called the beau ideal: a topic which has furnished occasion to so many over-refinements among the French critics, and to so much extravagance and mysticism in the cloud-capt metaphysics of the new German school. In considering imagination as connected with the nervous system more particularly as connected with that species of sympathy to which medical writers have given the name of imitation, he has suggested some very important hints which none of his successors have yet prosecuted; and has, at the same time, left an example of cautious enquiry, worthy to be studied by all who may attempt to investigate the laws regulating the union between mind and body. His illustration of the different classes of prejudices incident to human nature, is, in point of practical utility, at least equal to any thing on that head to be found in Locke; of whom it is impossible to forbear remarking, as a circumstance not easily explicable, that he should have resumed this important discussion without once mentioning the name of his great predecessor. The chief improvement made by Locke, in the farther prosecution of the argument, is the application of Hobbes's theory of association, to explain in what manner these prejudices are originally generated.

'In Bacon's scattered hints on topics connected with the philosophy of the mind, strictly so called, nothing is more remarkable than the precise and just ideas they display of the proper aim of this science. He had manifestly reflected much and successfully on the operations of his own understanding, and had studied, with uncommon sagacity, the intellectual characters of others. Of his reflections and observations on both subjects he has recorded many important results; and has in general stated them without the slightest reference to any physiological theory concerning their causes, or to any analogical explanations founded on the caprices of metaphorical language. If, on some occasions, he assumes the existence of animal spirits, as the medium of communication between soul and body, it must be remembered that this was then the universal belief of the learned; and that it was, at a much later period, not less confidently avowed by Locke. Nor ought it to be overlooked (I mention it to the credit of both authors) that in such instances the fact is commonly so stated, as to render it easy for the reader to detach it from the theory. As to the scholastic questions concerning the nature and essence of mind,—whether it be extended or unextended? whether it have any relation to space or time? or whether (as was contended by others) it exist in every ubi but in no place? Bacon has uniformly passed them over with silent contempt; and has probably contributed not less effectually to bring them into general discredit by this indirect intimation of his own opinion, than if he had descended to the ungrateful task of exposing their absurdity.

'While Bacon, however, so cautiously avoids these unprofitable discussions about the nature of mind, he decidedly states his conviction that the faculties of man differ not merely in degree, but in kind, from the instincts of the brutes. 'I do not therefore,' he observes on one occasion, 'approve of that confused and promiscuous method in which philosophers are accustomed to treat of pneumatology; as if the human soul ranked above those of brutes merely like the sun above the stars, or like gold above other metals.

'Among the various topics stated by Bacon, for the consideration of future logicians, he did not overlook (what may be justly regarded, in a practical view, as the most interesting of all logical problems) the question concerning the mutual influence of thought and of language on each other. 'Men believe,' says he, 'that their reason governs their words, but it often happens that words have power enough to re-act upon reason.' This aphorism may be considered as the text of by far the most valuable part of Locke's Essay,—that which relates to the imperfections and abuse of words; but it was not till within the last twenty years that its depth and importance were perceived in all their extent. I need scarcely say that I allude to the excellent Memoirs of M. Prevost, and of M. Degerando, on 'Signs considered in their connexion with the Intellectual Operations.' The anticipations formed by Bacon of that branch of modern logic which relates to universal grammar do no less honor to his sagacity. 'Grammar,' he observes, 'is of two kinds: the one literary, the other philoso-

phical. The former has for its object to trace the analogies running through the structure of a particular tongue, so as to facilitate its acquisition to a foreigner, or to enable him to speak it with correctness and purity. The latter directs the attention not to the analogies which words bear to words, but to the analogies which words bear to things,' or, as he afterwards explains himself more clearly, 'to language considered as the sensible portraiture or image of the mental processes.' In farther illustration of these hints he takes notice of the light which the different genius of different languages reflects on the characters and habits of those by whom they were respectively spoken. 'Thus,' says he, 'it is easy to perceive that the Greeks were addicted to the culture of the arts, the Romans engrossed with the conduct of affairs; inasmuch as the technical distinctions introduced in the progress of refinement require the aid of compounded words; while the real business of life stands in no need of so artificial a phraseology.' Ideas of this sort have, in the course of a very few years, already become common, and almost tritical; but how different was the case two centuries ago! It would be endless to particularise the original suggestions thrown out by Bacon on topics connected with the science of mind. The few passages of this sort already quoted are produced merely as specimens of the rest. They are by no means selected as the most important in his writings; but, as they happened to be those which left the strongest impression on my memory, I thought them as likely as any other to invite the curiosity of my readers to a careful examination of the rich mine from which they are extracted. His small volume of Essays, the best known and most popular of all his works, may be read from beginning to end in a few hours,—and yet, after the twentieth perusal, one seldom fails to remark in it something overlooked before. This, indeed, is characteristic of all Bacon's writings, and is only to be accounted for by the inexhaustible aliment they furnish to our own thoughts, and the sympathetic activity they impart to our torpid faculties.'

Most of the above remarks are as critically just as they are elegantly expressed. Perhaps a little more concentration and definiteness, or less diffuseness and vagueness of statement, could be wished. If we may express our idea of Bacon's peculiar excellence in the fewest possible words, it consists in pointing out in such a manner as at once to arrest attention and flash conviction the various sources or causes of human error. No author ever did more for sound philosophy, whether considered in reference to mind or to matter; consequently, in as far as the term metaphysics imports sound thinking and reasoning or real and useful knowledge, Bacon is entitled to rank among the first and highest of metaphysical philosophers; but, in the more limited and usual application of the expression, Hobbes is unquestionably to be considered as the father of the modern metaphysics, variously designated, with too much of assumption and pretension perhaps, the physiology of the mind, the philosophy of the human mind, the science of mind, intellectual philosophy, &c.

HOBBES, GASSENDI, AND DESCARTES.

The end of the sixteenth and beginning of the seventeenth century was pre-eminently the age of great men. Bacon, Galileo, Kepler, Hobbes, Milton, Gassendi, Descartes, and not a few others of kindred spirit, were contemporaries. Bacon was born in 1561, Hobbes in 1588, Gassendi in 1592, Descartes in 1596. 'The period when Hobbes began his literary career,' says Mr. Stewart, 'as well as the principal incidents of his life, were in a singular degree favorable to a mind like his; impatient of the yoke of authority and ambitious to attract attention, if not by solid and useful discoveries, at least by an ingenious defence of paradoxical tenets. After a residence of five years at Oxford, and a very extensive tour through France and Italy, he had the good fortune upon his return to England to be admitted into the intimacy and confidence of lord Bacon; a circumstance which we may presume contributed not a little to encourage the bold spirit of enquiry, and that aversion to scholastic learning, which characterise his writings.' 'It is very remarkable that Descartes should have thought so highly of the ethical principles of Hobbes as to pronounce him a much greater master of morality than of metaphysics. Mr. Addison, on the other hand, gives a decided preference (among all the books written by Hobbes) to his Treatise on Human Nature; and to his opinion on this point I most implicitly subscribe; including, however, in the same commendation some of his other philosophical essays on similar topics. They are the only part of his works which it is now possible to read with interest; and they every where evince in their author, even when he thinks most unsoundly himself, the power of setting his reader a thinking, which is one of the most unequivocal marks of original genius. They have plainly been studied with the utmost care both by Locke and Hume. To the former they have suggested some of his most important observations on the association of ideas, as well as much of the sophistry displayed in the first book of his Essay on the Origin of our Knowledge, and on the factitious nature of our moral principles; to the latter (among a variety of hints of less consequence) his theory concerning the nature of those established connexions among physical events which it is the business of the natural philosopher to ascertain, and the substance of his argument against the scholastic doctrine of general conceptions. It is from the work of Hobbes, too, that our later Necessitarians have borrowed the most formidable of those weapons with which they have combated the doctrine of moral liberty; and from the same source has been derived the leading idea which runs through the philological materialism of Mr. Horne Tooke. It is probable, indeed, that this last author borrowed it at second hand from a hint in Locke's Essay; but it is repeatedly stated by Hobbes, in the most explicit and confident terms. Of this idea (than which, in point of fact, nothing can be imagined more puerile and unsound) Mr. Tooke's etymologies, when he applies them to the solution of metaphysical questions, are little more than an ingenious expansion

adapted and levelled to the comprehension of the multitude. The speculations of Hobbes, how ever, concerning the theory of the understanding, do not seem to have been nearly so much attended to during his own life as some of his other doctrines, which, having a more immediate reference to human affairs, were better adapted to the unsettled and revolutionary spirit of the times. It is by these doctrines, chiefly, that his name has since become so memorable in the annals of modern literature; and although they now derive their whole interest from the extraordinary combination they exhibit of acuteness and subtlety with a dead palsy in the powers of taste and of moral sensibility, yet they will be found, on an attentive examination, to have had a far more extensive influence on the subsequent history, both of political and of ethical science, than any other publication of the same period.'

Much of the above quotation is very just, though somewhat debased with that metaphysicum odium so characteristic of the school of Reid, Oswald, and Beattie. Indeed Mr. Stewart writes more in the spirit of a metaphysical partisan, we had almost said of a persecutor, when treating of Hobbes, Gassendi, and sometimes too of Locke, than in the dispassionate temper of philosophy. In this respect Dr. Thomas Brown is a noble exception, or rather he is a striking contrast to the other moral professors of the Scottish universities. Instead of presenting the ethical and political principles of Hobbes to prejudice the reader against his writings in toto, in the manner of Mr. Stewart, Dr. Brown thus notices the philosopher of Malmesbury:—'I may now proceed farther back, to another philosopher of great eminence, whose name, unfortunately for its reputation, is associated more with his political and religious errors, than with his analytical investigations of the nature of the phenomena of thought. The author to whom I allude is Hobbes, without all question one of the most acute intellectual enquirers of the country and age in which he lived. As the physiology of the mind, in Britain at least, seemed at that time to be almost a new science, he was very generally complimented by his contemporary poets as the discoverer of a new land. Some very beautiful Latin verses, addressed to him, I quoted to you in a former lecture, in which it was said on occasion of his work on Human Nature, that the mind, which had before known all things, was now for the first time made known to itself.

Omnia hactenus
Quæ nosse potuit, nota jam primum est sibi.

and in which be was said in revealing the mind, to have performed a work next in divinity to that of creating it.

Divinum est opus
Animum creare, proximum huic ostendere.

By Cowley, who styles him 'the discoverer of the golden lands of new philosophy,' he is compared to Columbus, with this difference, that the world which that great navigator found was left by him rude and neglected, to the culture of future industry; while that which Hobbes discovered might be said to have been at once explored by him and civilised. The eloquence of his strong and perspicuous style, I may remark by the way, seems to have met with equal commendation from his poetical panegyrists. His style is thus described in some verses of Sheffield, duke of Buckingham:—

Clear as a beautiful transparent skin,
Which never hides the blood, yet holds it in;
Like a delicious stream it ever ran,
As smooth as woman, but as strong as man.'

The reader is now acquainted with some of the characteristic peculiarities of Hobbes's intellect; but no one can have an adequate conception of it without reading his writings. Mr. Stewart has awarded, though reluctantly, something of due praise to the treatise on Human Nature; which might have been entitled Multum in Parvo. It may be read, as Mr. Stewart remarks of Bacon's Essays, through in a few hours, and yet, after the twentieth perusal, one seldom fails to remark in it something overlooked before. It has not only the merit of setting the reader a thinking, as remarked by the above critic: we cannot read it, so as to enter into the author's meaning, without thinking; and it is impossible to give any thing like adequate attention, without understanding his meaning; for he excels not only in brevity, but in clearness and definiteness; expressing with a lucidness and rigorous precision, peculiarly his own, his meaning, his whole meaning, and nothing but his meaning. In this respect, indeed, he not only excels—he is a contrast to nearly all other metaphysicians, especially to Locke and Hume. Much of his other excellence is owing indeed to this; for, of all who have been aware of the connexion between words and ideas for better or for worse, none ever kept the nature of that connexion so steadily and so constantly in view. To such as have studied what he has said on this subject, the third book of Locke's Essay (unquestionably the best in the whole work) will seem mere prosing verbiage—a wood of words, to use one of Locke's own happiest expressions.

The following paragraph at the conclusion of Leviathan is strikingly characteristic of the author, and descriptive of his opinion respecting language as the medium of thought:—'There is nothing I distrust more than my diction: which nevertheless I am confident (excepting the mischances of the press) is not obscure. That I have neglected the ornament of quoting ancient poets, orators, and philosophers, contrary to the customs of late times, whether I have done well or ill in it, proceedeth from my judgment, grounded on many reasons. For, first, all truth of doctrine dependeth either upon reason or upon scripture; both which give credit to many, but never receive it from any writer. Secondly, the matters in question are not of fact but of right, wherein there is no place for witnesses. There is scarcely any of those old writers that contradicteth not sometimes, both himself and others, which makes their testimonies insufficient. Fourthly, such opinions as are taken only upon the credit of antiquity are not intrinsically the judgment of those that cite them, but words that pass (like gaping) from mouth to mouth. Fifthly, it is often with a fraudulent design that some

stick their corrupt doctrines with the cloves of other men's wit. Sixthly, I find not that the ancients they cite took it for an ornament to do the like with those that wrote before them. Seventhly, it is a proof of indigestion when Greek and Latin sentences come up again unchanged. Lastly, though I reverence those men of ancient times, that either have written truth perspicuously, or that have put us in a better way to find it out ourselves; yet to the antiquity itself I think nothing due: for, if we will reverence age, the present is the oldest time. If the antiquity of the writer is to be reverenced, I am not sure that generally they to whom such honor is given were more ancient when they wrote than I am when now writing: but, if it be well considered, the praise of ancient authors proceeds not from reverence for the dead, but from the competition and mutual envy of the living.'

Perhaps pedantry never received a more caustic application.. The following quotations from Leviathan, the most obnoxious of all the author's productions, are presented partly on account of their importance, and partly that the reader may be enabled to form a judgment as to the soundness of Mr. Stewart's criticism concerning the 'only part of Hobbes's works which it is now possible to read with interest.'

'When two names are joined together into an affirmation; as thus, a man is a living creature; if the latter name, living creature, signify all that the former name man signifies, then the affirmation is true; otherwise it is false. For true and false are attributes of speech, not of things. And where speech is not, there is neither truth nor falsehood. Error there may be, as when we expect that which shall not be, or suspect what has not been: but in neither case can a man be charged with untruth. Seeing then that truth consisteth in the right ordering of names in our affirmations, a man that seeketh precise truth had need to remember what every name he uses stands for, and to place it accordingly, else he will find himself entangled in words as a bird in lime-twigs; the more he struggles, the more belimed.'

'By this it appears how necessary it is for any man, that aspires to true knowledge, to examine the definitions of former authors, and either to correct them where they are negligently set down, or to make definitions for himself. For the errors of definitions multiply themselves as the reckoning proceeds; and lead men into absurdities, which at last they see, but cannot avoid without reckoning anew from the beginning; in which lies the foundation of their errors. Hence it happens that they who trust to books, do as they that cast up many little sums into a greater, without considering whether those little sums were rightly cast up or not; and at last finding the error visible, and not mistrusting their first grounds, know not which way to clear themselves, but spend time in fluttering over books; as birds that have entered by the chimney, finding themselves enclosed in a chamber, flutter at the false light of a glass-window, for want of wit to consider which way they came in. So that in the right definition of names lies the first use of speech, which is the acquisition of science; and in wrong or no definitions lies the first abuse, from which proceed false and senseless tenets; which make those men that take their instruction from the authority of books, and not from their own meditation, to be as much below the condition of ignorant men, as men endued with true science are above it. For, between true science and erroneous doctrines, ignorance is in the middle. Natural sense and imagination [conception] are not subject to absurdity. Nature itself cannot err: and as men abound in copiousness of language, so they become more wise or more foolish than ordinary. Nor is it possible without letters for any man to become remarkably wise, or (unless his memory be hurt by disease an or ill-constitution of organs) remarkably foolish. For words are wise men's counters, they do but reckon by them; but they are the money of fools that value them by the authority of an Aristotle, a Cicero, or a Thomas.

'The names of such things as affect us; that is, which please and displease us (because all men are not alike affected with the same thing, nor the same man at all times), are, in the common discourses of men, of inconstant signification. For, seeing all names are imposed to signify our conceptions, and all our affections are but conceptions, when we conceive the same things differently we can hardly avoid naming them differently. For though the nature of that which we conceive of be the same, yet the diversity of our conception of it in consequence of different constitutions of body, and prejudices of opinion, gives every thing a tincture of our different passions. And, therefore, in reasoning a man must take heed of words, which, besides what we imagine to be their own signification, have a signification also of the nature, disposition, and interest, of the speaker; such as the names of virtues and vices; for one man calls wisdom what another calls fear; what one calls cruelty another calls justice, &c.' *Leviathan*, the first part of chap. iv. of Speech.

'When a man reckons without the use of words, which may be done in particular things (as when upon the sight of any one thing we conjecture what was likely to have preceded, or is likely to follow upon it); if that which he thought likely to follow, follow not, or that which he thought likely to have preceded it, has not preceded it; this is called error, to which even the most sagacious men are subject. But when we reason in words of general signification, and fall upon a general inference which is false, though it be commonly called error, it is indeed absurdity or senseless speech. For error is but a deception, in presuming that somewhat is past or to come, of which, though it were not past or not to come, yet there was no impossibility discoverable. But when we make a general affirmation, unless it be a true one, the possibility of it is inconceivable. And words whereby we conceive nothing but the sound, are those we call absurd, insignificant, and nonsense.

'Man excels all other animals in the faculty of reason; but this privilege is alloyed by another, and that is the privilege of absurdity, to which no living creature is subject but man; and, of men, those are of all most subject to it who

profess philosophy. For it is most true that Cicero somewhere says of them, 'that there can be nothing so absurd, but may be found in the books of philosophers. And the reason is manifest, for there is not one of them that begins his ratiocinations from the definitions or explications of the names he is to employ, which is a method that has been used only in geometry, whose conclusions have, therefore, been made indisputable.

'The first cause of absurd conclusions I ascribe to the want of right method in not beginning their ratiocinations from definitions; that, is settled significations of their words; as if they could cast accounts without knowing the value of the numeral words one, two, and three. The second cause of absurd assertions I ascribe to the giving of the names of bodies to accidents [qualities], or of accidents to bodies. The third I ascribe to the giving of the names of the qualities of bodies without us to the accidents or affections of our own bodies, as they do that say the color is in the object, the sound is in the air, &c. The fourth to the giving of the names of bodies to names or speeches, as they do that say there are things universal. The fifth to the giving of the names of accidents to names and speeches, as they do that say the nature of a thing is its definition, a man's command is his will, &c. The sixth, to the use of metaphor, tropes, and other rhetorical figures, instead of proper words. For though it be lawful to say, in common speech, the way goeth or leadeth hither or thither, the proverb says this or that, whereas ways cannot go nor proverbs speak; yet in reckoning and seeking of truth such speeches are not to be admitted. The seventh, to names or words that signify nothing, but are taken up and learned by rote from the schools. To him that can avoid these things, it is not easy to fall into any absurdity, unless it be by the length of an account, wherein he may perhaps forget what went before. For all men by nature reason alike and well when they have good principles; for who is so stupid as both to mistake in geometry, and also to persist in it when another detects his error to him? They that have no science are in a better and nobler condition with their natural prudence, than men are who, by mis-reasoning or by trusting those that reason wrong, fall upon false and absurd general rules. For ignorance of causes and of rules does not set men so far out of their way, as relying on false rules, and taking for causes of what they aspire to those that are not so, but rather causes of the contrary.' *Leviathan*, chap. v. Of Reason and Science.

As remarked by Hume, Stewart, Addison, and others, the Treatise on Human Nature is unquestionably, as a whole, the best of all the works of Hobbes, and it contains little or nothing of those opinions of a theological and ethical nature which have been considered dangerous, and which have excited so much odium. We refer the reader to it, and will not attempt a syllabus of that which is so remarkable for brevity, that it might be designated a breviary or manual of intellectual analysis. The following quotations are given as a specimen of the author's manner to those who are not acquainted with his writings.

'Concerning these points, as the writings of men from antiquity downwards have still increased, so have doubts and controversies: and seeing true knowledge begetteth not doubt or controversy, it is manifest, from the present controversies, that they who have heretofore written thereof have not well understood their own subject. Harm I can do none, though I err no less than they; for I shall leave men but as they are, in doubt and dispute; but intending not to take my principle upon trust, but only to put men in mind of what they know already, or may know by their own experience, I hope to err the less; and, when I do, it must proceed from too hasty concluding, which I will endeavour as much as I can to avoid. On the other side, if reasoning aright win not consent, which may easily happen from them that, being confident of their own knowledge, weigh not what is said, the fault is not mine but theirs; for as it is my part to show my reasons, so it is theirs to bring attention.'

This is sufficiently haughty towards the courteous and gentle reader. In this respect indeed Hobbes is a remarkable contrast to Locke; which accounts, perhaps, for their opposite fate as to popularity. But, though the tone of the author of Human Nature is sufficiently confident and dogmatic, he is modest in reference to the merits of his own favorite study. He never attempts to magnify its importance by lofty language,—he never speaks of intellectual phenomena—of the philosophy of mind, &c., &c. As we shall have occasion in the sequel to remark, such metaphysical grandiloquentia did not come into existence till long after the days of Hobbes and Locke.

The following is the author's manner of entering upon what would now be termed the physiology of mind :—

'Having declared what I mean by the word conception, and other words equivalent thereunto, I proceed to conceptions themselves, to show their differences, their causes, and the manner of the production, so far as is necessary for this place. Originally all conceptions proceed from the action of the thing itself whereof it is the conception: now, when the action is present, the conception it produces is also called sense, and the thing by whose action the same is produced is called the object of the sense. By our several organs we have several conceptions of several qualities in the objects; for by sight we have a conception or image composed of color and figure, which is all the notice and knowledge the object imparts to us of its nature by the eye. By hearing we have a conception called sound, which is all the knowledge we have of the quality of the object from the ear. And so the rest of the senses are also conceptions of several qualities of their objects. Because the image in vision, consisting of color and shape, is the knowledge we have of the qualities of the object of that sense; it is no hard matter for a man to fall into this opinion, that the same color and shape are the very qualities themselves; and, for the same cause, that sound and noise are the qualities of the bell, or of the air. And this opinion hath been so long received that the contrary must needs appear a great paradox; and yet the intro

duction of species visible and intelligible (which is necessary to the maintenance of that opinion) passing to and from the object, is worse than any paradox, as being a plain impossibility. I shall therefore endeavour to make plain these points.

'That the subject wherein color and image are inherent is not the object or thing seen.

'That there is nothing without us (really) which we call an image or color.

'That the said image or color is but an appearance to us of the motion, agitation, or alteration, which the object worketh in the brain, or spirits, or some internal substance of the head.

'That, as in vision, so also in conceptions that arise from the other senses, the subject of their inherence is not the object, but the sentient.

'Every man has seen the sun and other visible objects by reflection in water and in glass; and this alone is sufficient for the conclusion that color and image may be where the thing seen is not. But because it may be said that though the image in the water is not in the object, but a mere appearance, yet there may be color really in the thing itself: I will urge further this experience, that frequently men see directly the same object double, as two candles for one, the colors and figures in two such images of the same thing cannot be inherent therein, because the thing seen cannot be in two places. One of these images therefore is not inherent in the object; consequently neither of them is absolutely inherent.

'As color is not inherent in the object, but an effect thereof upon us, so neither is sound in the thing we hear, but in ourselves. One manifest sign thereof is that, as a man may see, so also he may hear double or treble, by multiplication of echoes, which echoes are sounds as well as the original; and, not being in one and the same place, cannot be inherent in the body that causes them: nothing can make any thing which is not in itself: the clapper has no sound in it, but motion, and makes motion in the internal parts of the bell; so the bell has motion, and not sound, that imparts motion to the air; and the air hath motion, but not sound; the air imparts motion by the ear and nerve to the brain; and the brain hath motion, but not sound: from the brain it rebounds back into the nerves outward, and thence it becomes an appearance without, which we call sound. And, to proceed to the rest of the senses, it is apparent enough that the smell and taste of the same thing are not the same to every man; and therefore are not in the thing smelled or tasted, but in the men. So likewise the heat we feel from the fire is manifestly in us, and is quite different from what is in the fire; for our heat is pleasure or pain, according as it is great or moderate; but in the coal there is no such thing. Thus, as in vision, so also in conceptions that arise from other senses, the subject of their inherence is not in the object, but in the sentient. Hence also it follows that whatsoever accidents or qualities our senses make us think there are in the world, they are not actually there, but are appearances only: the things that really are in the world without us are those motions by which these appearances are caused. And this is the great deception of sense, which is also to be corrected by sense. for as sense tells me, when I see directly, that the color seems to be in the object; so also sense tells me, when I see by reflection, that color is not in the object.'

The reader may judge for himself how much more has been made of these matters, with all their laborious ingenuity, by Locke, Berkeley, Brown, and so many others.

The following is the germe of the famous doctrine of the association of ideas, so amply philosophised by Locke, Hartley, Hume, &c. &c.:—

'The succession of conceptions in the mind, one after another, may be casual and incoherent as in dreams for the most part; and it may be orderly, as when the former thought introduceth the latter; and this is discourse of the mind. But because discourse is commonly taken for the coherence and sequence of words, I will, to avoid equivocation, call it discussion. The cause of the coherence, or sequence of one conception to another, is their first coherence or sequence at that time when they are produced by sense. As, for example, from St. Andrew the mind runs to St. Peter, because their names are read together; from St. Peter to a stone for the same cause; from stone to foundation, because we see them together; and, for the same cause, from foundation to church; from church to people; and from people to tumult: and according to this example the mind may run almost from any thing to any thing. But as, in the sense, the conception of cause and effect may succeed one another, so may they after sense in the imagination. And for the most part they do so; the cause whereof is the desire of those who, having a conception of the end, have next to it a conception of the next means to that end: as when a man, from a thought of honor to which he has a desire, comes to the thought of wisdom, which is the next means thereunto; and from thence to study, which is the next means to wisdom.'

As the above is evidently the original of all that has since been advanced concerning the association of ideas, so with hardly any exception all that has been advanced on other topics by subsequent metaphysicians of greatest note may be found in a seminal or latent state in the writings of Hobbes. Mr. Stewart notices, as hardly consistent with gratitude or candor, that the only mention which Locke makes of the father of philosophic metaphysics is rather condemnatory than eulogial. It is probable, indeed, that Mr. Locke was afraid to commend even what was good in Hobbes, or to acknowledge that he had borrowed nearly all his ideas from one who was proscribed by common consent.

Before leaving the author of Leviathan, it may be proper to notice his theological and political heresies. They are unquestionably of a very objectionable nature. But it is much to be regretted that they have been much more met by violent clamor than by forcible reasoning; and it is also matter of regret that there has been so little discrimination in established or general opinion between what is good and what is bad in the philosopher of Malmesbury; who, according to Warburton, 'was the terror of the last age.'

'The press (continues the author of the Divine Legation) sweats with controversy, and every young churchman militant would try his arms in thundering at Hobbes's steel cap. 'Nor was the opposition to Hobbes,' remarks Mr. Dugald Stewart, 'confined to the clerical order, or to controversialists of his own times. The most eminent moralists and politicians of the eighteenth century may be ranked in the number of his antagonists; and even at the present moment scarcely does there appear a new publication on ethics or jurisprudence where a refutation of Hobbism is not to be found.' All this confesses at least that the object of so much animadversion and refutation is an intellectual leviathan. But Mr. Stewart might have added that there is scarcely one of the almost innumerable refutations which does justice to the hated author, or to his most hateful principles. We would give him fair play, all wicked and hateful as he is, and think the evil principles and reasonings of Hobbes might be opposed much more effectually and successfully than has yet been done. His atheism is not that of Epicurus or Spinoza. He was too acute a logician to blunder in the manner of either, and he was too honest to reason as his disciple Hume. He knew well how far to go, and when to stop. Nor can he be fairly charged with sophistry in argument. Grant his principle, and his reasoning is impregnable. He plainly and boldly propounds his opinion, which is unquestionably virtual atheism, morally and religiously considered; viz. that it is absurd to deny the being of a God, or first cause, but equally absurd to affirm that it is possible to know what he, or rather it is; because it is impossible to have an idea or image of God in the mind.

'Curiosity,' he says (Leviathan part I. chap. 2.), 'or love of the knowledge of causes, draws a man from consideration of the effect, to seek the cause; and again the cause of that cause; till of necessity he must come to this thought at last, that there is some cause whereof there is no former cause, but is eternal; which is it men call God. So that it is impossible to make any profound enquiry into natural causes without being inclined thereby to believe there is one God eternal; though they cannot have any idea of him in their mind answerable to his nature. For as a man that is born blind, hearing men talk of warming themselves by the fire, and being brought to warm himself by the same, may easily conceive and assure himself there is somewhat there which men call fire, and is the cause of the heat he feels, but cannot imagine what it is like nor have an idea of it in his mind, such as they have that see it; so also by the visible things of this world, and their admirable order, a man may conceive there is a cause of them which men call God, and yet not have an idea or image of him in his mind.'

This is perfectly true in the obvious sense of idea or image in reference to God; and yet it does not follow that we can have no knowledge of the intellectual or moral nature of God, which is what, however, Hobbes means. This is the root of all his ethical and political heresies; and we are convinced that it admits of the fullest and most satisfactory refutation. Indeed nothing can exhibit more strikingly the unsoundness of the author's theory of human knowledge, in connexion with idea or image as actually constituting it, than the above quotation. But we must not dwell longer on the topic in this place; it will probably come under consideration elsewhere.

Having said so much of Hobbes, it is not necessary to devote many sentences to his contemporary and friend Gassendi, who may be regarded as his metaphysical disciple, as he was an enthusiastic admirer of his writings as well as of those of Bacon. His metaphysical opinions, even when not adopted from Hobbes, coincided entirely with that of the latter philosopher, being derived from Epicurus. The intellectual character of Gassendi was certainly above mediocrity; but he was much inferior to Hobbes in acuteness, comprehension, and originality, and in some respects to his opponent Descartes, for he possessed less genius. Gibbon pronounces him le meilleur philosophe des litterateurs, et le meilleur litterateur des philosophes. 'His learning,' remarks Mr. Stewart 'was at once vast and accurate; and as a philosopher he is entitled to the praise of being one of the first who entered thoroughly into the spirit of the Baconian logic. But his inventive powers, which were probably not of the highest order, seem to have been either dissipated amidst the multiplicity of his literary pursuits, or laid asleep by his indefatigable labors, as a commentator and a compiler. From a writer of this class, new lights were not to be expected in the study of the human mind, and accordingly here he has done little or nothing, but to revive and repeat over the doctrines of the old Epicureans. His works amount to six large volumes in folio; but the substance of them might be compressed into a much smaller compass without any diminution of their value.'

The above critique is on the whole just; but the last sentence was a hazardous one for a critic to risk who is more remarkable for diffuseness than for condensation. It was said of Addison that, in his rules of criticism, he supplied weapons against himself. In voluminousness, as well as in other respects, Gassendi was a striking contrast to his friend Hobbes, who had certainly that attribute of a wise man, according to the old proverb, that he was sparing of his words. We are told by Sorbière that, having received De Corpore a few months before his death, Gassendi kissed it, adding, This book is indeed a little one, but it is full of matter, or rather it is all marrow. 'Thomas Hobbius Gassendo charissimus, cujus libellum De Corpore paucis ante obitum mensibus accipiens, osculatus est subjungens, mole quidem parvus est iste liber, verùm totus, ut opinor, medulla scatet.'

One quotation more from Mr. Stewart, respecting Gassendi, merits insertion. 'As Gassendi's attachment to the physical doctrines of Epicurus predisposed him to give an easier reception, than he might have otherwise done, to his opinions in metaphysics and in ethics; so his unqualified contempt for the hypothesis of the Vortices seems to have created in his mind an undue prejudice against the speculations of Descartes on all

other subjects. His objections to the argument by which Descartes has so triumphantly established the distinction between mind and matter, as separate and heterogeneous objects of human knowledge, must now appear, to every person capable of forming a judgment upon the question, altogether frivolous and puerile; amounting to nothing more than this, that all our knowledge is received by the channel of the external senses, insomuch that there is not a single object of the understanding which may not be ultimately analysed into sensible images; and of consequence that, when Descartes proposed to abstract from these images in studying the mind, he rejected the only materials out of which it is possible for our faculties to rear any superstructure. The sum of the whole matter is (to use his own language), that 'there is no real distinction between imagination and intellection;' meaning, by the former of these words, the power which the mind possesses of representing to itself the material objects and qualities it has previously received. It is evident that this conclusion coincides exactly with the tenets inculcated in England, at the same period, by his friend Hobbes, as well as with those revived at a later period by Diderot, Horne Tooke, and many other writers both French and English, who, while they were only repeating the exploded dogmas of Epicurus, fancied they were pursuing, with marvellous success, the new path struck out by the genius of Locke.

'It is worthy of remark that the argument employed by Gassendi against Descartes is copied almost verbatim from his own version of the account given by Diogenes Laertius of the sources of our knowledge, according to the principles of the Epicurean philosophy;—so very little is there of novelty in the consequences deduced by modern materialists from the scholastic proposition, Nihil est in intellectu quod non fuit prius in sensu. (There is nothing in the intellect or mind which was not previously in the sense or senses.) The same doctrine is very concisely and explicitly stated in a maxim formerly quoted from Montaigne, that 'The senses are the beginning and end of all our knowledge;' a maxim which Montaigne learned from his oracle Raymond de Sebonde: which, by the present race of French philosophers, is almost universally supposed to be sanctioned by the authority of Locke; and which, if true, would at once cut up by the roots, not only all metaphysics, but all ethics, and all religion, both natural and revealed.'

'A learned and profound writer has lately complained of the injustice done by the present age to Gassendi; in whose works, he asserts, may be found the whole of the doctrine commonly ascribed to Locke concerning the origin of our knowledge. The remark is certainly just, if restricted to Locke's doctrine as interpreted by the greater part of philosophers on the continent; but it is very wide of the truth if applied to it as now explained and modified by the most intelligent of his disciples in this country. The main scope, indeed, of Gassendi's argument against Descartes is to materialise that class of our ideas which the Lockeists, as well as the Cartesians, consider as the exclusive objects of the power of reflection; and to show that these ideas are ultimately resolvable into images or conceptions borrowed from things external. It is not, therefore, what is sound and valuable in this part of Locke's system, but the errors grafted on it in the comments of some of his followers, that can justly be said to have been borrowed from Gassendi. Nor has Gassendi the merit of originality even in these errors; for scarcely a remark on the subject occurs in his works but what is copied from the accounts transmitted to us of the Epicurean metaphysics.'

The author above referred to as complaining of the injustice done to Gassendi is De Gerando, Hist. Comp. des Systèmes, tome 1. His words are, 'Gassendi was the first author of the new philosophy of the human mind; for it is time to render to him that justice which he has hardly ever received even from his own countrymen. It is very remarkable that, in speaking of the new philosophy of the human mind, we always say the philosophy of Locke. D'Alembert and Condellac have authorised this expression, both ascribing to Locke exclusively the glory of this invention or discovery. Gassendi fut le premier auteur de la nouvelle philosophie de l'esprit humain; car il est tems de lui rendre, à cet égard, une justice qu'il n'a presque jamais obtenue de ses propres compatriotes. Il est très singulier en effet, qu'en parlant de la nouvelle philosophie de l'esprit humain, nous disions toujours la philosophie de Locke. D'Alembert et Condillac ont autorisé, cette expression, en rapportant l'un et l'autre à Locke exclusivement la gloire de cette invention.'

There is a portion of vague and incorrect statement in the above quotation from Mr. Stewart, which we shall have occasion to notice in a subsequent part; and it is now time to dismiss Gassendi.

Descartes will not detain us long; for all admit that, whatever were his other merits, he was a very unsound and wild metaphysician. It is true that he did much for free enquiry, and even his errors had, in some respects, considerable use. According to Condorcet he is better entitled, than any other individual, to be regarded as the father of that spirit of free enquiry which distinguishes modern Europe; and, according to Mr. Stewart, he may be considered the father of the experimental philosophy of the human mind. As the last mentioned critic is sufficiently disposed to admire and praise Descartes, and as his remarks are somewhat curious, if not always sound, we shall give a few quotations from him concerning 'the father of the experimental philosophy of the human mind.'

'The first steps of Descartes are peculiarly interesting and instructive; and it is these alone which merit our attention at present. As for the details of his system they are now curious only as exhibiting an amusing contrast to the extreme rigor of the principle whence the author sets out; a contrast so very striking as fully to justify the epigrammatic saying of D'Alembert, that Descartes began with doubting every thing, and ended in believing that he had left nothing unexplained.

'Among the various articles of common belief, which Descartes proposed to subject to a severe scrutiny, he enumerates particularly the conclusiveness of mathematical demonstration; the existence of God; the existence of the material world; and even the existence of his own body. The only thing that appeared to him certain and incontrovertible was his own existence; by which, he repeatedly reminds us, we are to understand merely the existence of his mind, abstracted from all consideration of the material organs connected with it. About every other proposition he conceived that doubts might reasonably be entertained; but to suppose the nonexistence of that which thinks, at the very moment it is conscious of thinking, appeared to him a contradiction in terms. From this single postulatum, accordingly, he took his departure; resolved to admit nothing as a philosophical truth which could not be deduced from it by a chain of logical reason. * * * Extravagant and hopeless as these preliminary steps must now appear, they had nevertheless an obvious tendency to direct the attention of the author in a singular degree to the phenomena of thought, and to train him to those habits of abstraction from external objects, which, to the bulk of mankind, are next to impossible. In this way he was led to perceive, with the evidence of consciousness, that the attributes of mind were still more clearly and distinctly knowable than those of matter; and that in studying the former, so far from attempting to explain them by analogies borrowed from the latter, our chief aim ought to be to banish, as much as possible, from the fancy, every analogy, and even every analogical expression, which, by inviting the attention abroad, might divert it from its proper business at home. In a word, that the only right method of philosophising on this subject was comprised in the stoical precept (understood in a sense somewhat different from that originally annexed to it), Nec te quæsiveris extra. A just conception of this rule, and a steady adherence to its spirit, constitutes the groundwork of what is properly called the experimental philosophy of the human mind. It is thus that all our facts relating to mind must be ascertained; and it is only on facts thus attested by our own consciousness that any just theory of mind can be reared.'

This sounds high or seems wonderful; but let us hear the sum of the whole matter. 'The glory, however, of having pointed out to his successors the true method of studying the theory of mind is almost all that can be claimed by Descartes in logical and metaphysical science. Many important hints indeed may be gleaned from his works; but on the whole he has added very little to our knowledge of human nature.' Alas! for the experimental philosophy of the human mind! But let us hear Mr. Stewart once more: 'Among the principal articles of the Cartesian philosophy, which are now incorporated with our prevailing and most accredited doctrines, the following seem to me to be chiefly entitled to notice.

'1. His luminous exposition of the common logical error of attempting to define words which express notions too simple to admit of analysis. Mr. Locke claims this improvement as entirely his own; but the merit of it unquestionably belongs to Descartes, although it must be owned that he has not always sufficiently attended to it in his own researches.'

There is here a two-fold error in awarding unmerited praise to Descartes, who was not the first to remonstrate against attempting impossible definition; and in applying unmerited censure to Locke, who does not claim what Mr. Stewart terms an improvement as entirely his own. His words are, 'The names of simple ideas are not capable of any definition, the names of complex ideas are.—It has not, that I know, been yet observed by any body, what words are and what words are not capable of being defined.' This admits of a very different interpretation from that put upon it by the critic; and the modesty of Mr. Locke, in saying, 'it has not that I know been yet observed by any body,' ought to have protected him from the charge of setting up a false claim. But let Mr. Stewart proceed with the merits of the father of the experimental philosophy of the human mind.

'2. His observations on the different classes of our prejudices, particularly in the errors to which we are liable in consequence of a careless use of language as the instrument of thought. The greater part of these observations, if not the whole, had been previously hinted at by Bacon; but they are expressed by Descartes with greater simplicity, and in a style better adapted to the taste of the present age.'

Here, liberal as the critic in general is of praise to the English father of experimental philosophy, he would abstract some merit from him to bestow it on the French father of the experimental philosophy of mind. But if Bacon failed, did not Hobbes point out with sufficient precision and simplicity the different classes of prejudice; particularly on the errors to which we are liable in consequence of a careless use of language as the instrument of thought?

'3. The paramount and indisputable authority, which, in all our reasonings concerning the human mind, he ascribes to the evidence of consciousness.'

Has not Hobbes ascribed as much to consciousness as Descartes? and was not the former prior in time to the latter?

'4. The most important, however, of all his improvements in metaphysics, is the distinction which he has so clearly and so strongly drawn between the primary and the secondary qualities of matter. This distinction was not unknown to some of the ancient schools of philosophy in Greece; but it was afterwards rejected by Aristotle and by the schoolmen; it was reserved for Descartes to place it in such a light, as (with the exception of a very few sceptical or rather paradoxical theorists) to unite the opinions of all succeeding enquirers. It may be proper to remark that the epithets primary and secondary now universally employed to mark the distinction in question, were first introduced by Locke; a circumstance which may have contributed to throw into the shade the merits of those enquirers who had previously struck into the same path.'

We shall examine the merits of this boasted

distinction, when we come to Dr. Brown's Lectures. In the mean time it is evident, from Mr. Stewart's own showing, that it was only a revival of an old opinion, which he has shown in the case of Gassendi is no great matter. But who has written more simply, more clearly, more intelligibly, concerning the point in question than Hobbes? We refer the reader to the quotation made from the Treatise on Human Nature.

Among the other vagaries of Descartes was his notable one in assigning the pineal gland, or conarium, as the principal seat of the soul, because, among the different parts of the brain, this was the only one he could find, being single and central, that was fitted for the habitation of a being, of which he conceived unity and individuality to be essential and obvious attributes. This ludicrous notion is wittily alluded to in the Alma of Prior—

> —— Here Matthew said
> Alma in verse, in prose the mind
> By Aristotle's pen defined,
> Throughout the body squat or tall
> Is bonâ fide all in all;
> And yet slap-dash is all again
> In every sinew, nerve, and vein;
> Runs here and there like Hamlet's ghost,
> While every where she rules the roast.
> This system, Richard, we are told
> The men of Oxford firmly hold;
> The Cambridge wits, you know, deny
> With ipse dixit to comply—
> They say (for in good truth they speak
> With small respect of that old Greek)
> That, putting all his words together,
> 'Tis three blue beans in one blue bladder;
> Alma, they strenuously maintain,
> Sits cock-horse on her throne the brain;
> And from that seat of thought dispenses
> Her sovereign pleasure to the senses, &c. &c.

Perhaps the reader, notwithstanding all the strenuous criticism on the merits of Descartes to which we have adverted, will be disposed to say with Prior—

> That, putting all his words together,
> 'Tis three blue beans in one blue bladder.

In connexion with Descartes some slight notice is due to his disciple Malebranche, who commenced his literary career about twenty-five years after the death of the former; and who, with all his Platonic mysticism, possessed uncommon genius, and wrote with great eloquence. His Search of Truth, La Recherche de la Verité, is a charming work, concerning which the reader is ready to exclaim, in the words of Cowper, in reference to his country, 'with all thy faults I love thee still.' It contains a wonderful mixture of beauty and deformity, of truth and error, wisdom and folly.

La Recherche de la Verité is well charactensed by Dr. Brown, in his thirtieth lecture, as 'a work which is distinguished by much eloquence, and by many profound remarks on the sources of human error, but which is itself an example in the great system which it supports, of error as striking as any of those which it eloquently and profoundly discusses. It is truly unfortunate for his reputation, as a philosopher, that these discussions do not form a separate work, but are blended with his own erroneous system, the outline of which every one knows too well to think of studying its details. All that is necessary to give him his just reputation is merely that he should have written less. He is chiefly known at present as the author of a very absurd hypothesis. He would have been known and studied, and honored, as a very acute observer of our nature, if he had never composed those parts of his work, to which, probably, when he thought of other generations, he looked forward as to the basis of his philosophic fame. His hypothesis, as many of you probably know, is, that we perceive not objects themselves, but the ideas of them which are in God.'

Locke, Hartley, Berkeley, and others, have borrowed freely from Malebranche; the first his notion of habits; the second, his theory of vibrations; the third (probably at least), his ideal theory. Berkeley had once a short interview with Malebranche (and never, perhaps, were there two men better entitled to be designated twin spirits), when the conversation turned, as might be expected, on the non-existence of matter. Malebranche, who had an inflammation on his lungs, and whom Berkeley found preparing a medicine in a small pipkin, in his cell, exerted his voice so violently in the heat of dispute, that he increased his disorder, which carried him off a few days after, 1715, in the seventy-seventh year of his age.

Having mentioned Berkely, as a kin, metaphysically considered, to Malebranche, it is sufficient to say of him in the words of Dr. Brown, already quoted, 'that he is now chiefly known as the author of a very absurd hypothesis, viz that material objects have no other existence than in the mind. His writings display much acuteness and genius, and contain many important remarks, though they are now little read, and scarcely ever alluded to; for, as Warburton justly remarks (and the remark is not the less true and forcible for being applicable also to his own writings), 'fanciful hypotheses, when grown stale, are the most nauseous of all things.'

LOCKE AND LEIBNITZ.

These names are prominently identified with the metaphysical history of the eighteenth century. To connect Locke, Leibnitz, and their most eminent contemporaries, with their yet more eminent predecessors, it may be remarked, that Bacon died in 1626, Kepler in 1630, Galileo in 1642, Descartes in 1650, Gassendi in 1655, old Hobbes, as he is sometimes designated (for he lived ninety years in the world), in 1679. Locke was born in 1632, Malebranche in 1638, Newton in 1642, Leibnitz in 1646, Clarke in 1675. Locke is prior to Leibnitz both in the order of time and in metaphysical rank; but as it is not necessary to say much of the latter, and as he properly classes with Cudworth, who was prior in time to Locke, we shall dispose of the German metaphysician first.

Leibnitz, the rival of Newton, was unquestionably a very extraordinary man; but, metaphysically considered, he is now like Descartes, Malebranche, and Berkeley, chiefly known as the author of some very wild hypotheses. The following

quotation from Mr. Stewart has the merit of more than usual simplicity and brevity, especially in his Dissertations, establishing a general view of Metaphysical, Ethical, and Political Philosophy. 'The opinion of Leibnitz concerning the origin of our knowledge, though expressed in a different phraseology, agrees in the most essential points with the innate ideas of the Cartesians; but it approaches still more nearly to some of the mystical speculations of Plato. The very exact coincidence between the language of Leibnitz on this question and that of his contemporary Cudworth, whose mind, like his own, was deeply tinctured with the Platonic metaphysics, is not unworthy of notice as an historical fact. 'The seeds of our acquired knowledge,' says Leibnitz, 'or, in other words, our ideas, and the eternal truths which are derived from them, are contained in the mind itself; nor is this wonderful, since we know, by our own consciousness, that we possess within ourselves the ideas of existence, of unity, of substance, of action, and other ideas of a similar nature.' To the same purpose we are told by Cudworth, that 'the mind contains in itself naturally (as the future plant or tree is contained in the seed) general notions of all things which unfold and discover themselves as occasions invite, and proper circumstances occur.' The metaphysical theories, to the establishment of which Leibnitz chiefly directed the force of his genius, are the doctrine of pre-established harmony, and the scheme of optimism, as new-modelled by himself. According to the system of pre-established harmony, the human mind and human body are two independent, but constantly correspondent, machines; adjusted to each other like two unconnected clocks, so constructed that, at the same instant, the one should point the hour, and the other strike it. 'I cannot help coming into this notion,' says Leibnitz, in his Essay entitled Theodicæa, 'that God created the soul in such a manner at first, that it should represent within itself all the simultaneous changes in the body; and that he has made the body also in such a manner, as that it must of itself do what the soul wills; so that the laws which make the thoughts of the soul follow each other in regular succession must produce images which shall be co-incident with the impressions made by external objects upon our organs of sense; while the laws by which the motions of the body follow each other are likewise so coincident with the thoughts of the soul, as to give to our volitions and actions the very same appearance as if the latter were really the natural and necessary consequences of the former. Every thing goes on in the soul as if it had no body; and every thing goes on in the body as if it had no soul.'

We will not trouble our readers with more of this philosophic folly. It is hardly possible to avoid the suspicion, entertained by Le Clerc and others, that the opinions maintained by Leibnitz were not his real sentiments; but mere moot displays of ingenuity, if not a sham defence of religious and moral principles, for the purpose of more effectually delivering them over to the enemy. Indeed Gibbon unhesitatingly asserts, that, 'in his defence of the attributes and providence of the Deity, he was suspected of a secret correspondence with his adversary Bayle.' The evidence contained in a letter of Leibnitz to Pfaffins, professor of theology in the university of Tubingen, seems conclusive that he was at least only in sport (a very wanton if not wicked kind of sport, however) on subjects, which are either all-important or of no importance. In the letter alluded to, Leibnitz says, 'It is exactly as you write concerning my Theodicæa; and I wonder that no one should have hitherto discovered my design. For it is not the part of philosophers always to treat subjects seriously; who in framing hypotheses, as you justly remark, try the force of their genius. You who are a theologian, in refuting errors, act or play the theologian.' Ita prorsus est vir summe reverende, uti scribis, de Theodicæa mea. Rem acu tetigisti; et miror, neminem hactenus fuisse, qui sensum hunc meum senserit. Neque enim philosophorum est rem serio semper agere; qui in fingendis hypothesibus, uti bene mones, ingenii sui vires experiuntur. Tu qui theologus, in refutandis erroribus, theologium agis.

The manner in which Mr. Stewart attempts to nullify this evidence is curious. In reply to this, it is observed by the learned editor of Leibnitz's works, that 'it is much more probable that Leibnitz should have expressed himself on this occasion in jocular and ironical terms, than that he should have wasted so much ingenuity and learning in support of an hypothesis to which he attached no faith whatever; an hypothesis (he might have added) with which the whole principles of his philosophy are systematically, and, as he conceived, mathematically connected.'

Upon this hypothesis of jocularity, or irony, what evidence of words may not be evaded? As to probability and improbability we think it very likely that Leibnitz, in his sober serious moments, considered the greater part of his philosophical or mathematical principles, such as the sufficient reason, the law of continuity, negative quantities (concerning which his language is truly marvellous), &c. &c., in much the same light as his theory of the origin of knowledge, of pre-established harmony, and of optimism. The fact is, as we have intimated in the article MATHEMATICS, there is an intimate connexion between mathematical and metaphysical absurdity; and therefore the profoundest mathematicians are usually the wildest metaphysicians; such as Descartes and Leibnitz; nor are Newton and Clarke exceptions to the general rule. Thus Newton, for example, expresses himself concerning what it would have been more a proof of wisdom to be silent than to darken counsel by words without knowledge. Æternus est infinitus, omnipotens, et omnisciens; id est, durat ab æterno ad æternum, et adest ab infinito in infinitum. Non est æternitas et infinitas, sed æternus et infinitus; non est duratio et spatium, sed durat et adest. Durat semper et adest ubique, et existendo semper et ubique durationem et spatium constituit. Thus translated by Dr. Clarke, 'God is eternal and infinite, omnipotent and omniscient; that is, he endures from everlasting to everlasting, and is present from infinity to infinity. He is not eternity or infinity, but eternal and infinite. He is not duration or space, bu

he endures and is present. He endures always, and is present everywhere; and, by existing always and everywhere, constitutes duration and space.' It is on this notable definition that Clarke's celebrated à priori argument for the existence of God is founded. He argues that as immensity and eternity (which force themselves on our belief as necessary to existence), are not substances but attributes, the immense and eternal Being whose attributes they are must exist of necessity also. 'These,' says Dr. Reid, 'are the speculations of men of superior genius; but whether they be as solid as they are sublime, or whether they be the wanderings of imagination in a region beyond the limits of the understanding, I am at a loss to determine.' The concluding part of the sentence is expressive of the writer's modesty, or rather unwillingness to offend the admirers of Newton and Clarke; but no one, who will really be at the trouble to think, can be at a loss to determine respecting such vain attempts to go beyond the limits of the understanding by the aid of unmeaning phraseology.

Having spoken of the pre-established harmony of Leibnitz, Dr. Brown adds, 'To say of this hypothesis, which was the dream of a great mind—but of a mind, I confess, which was very fond of dreaming, and very apt to dream—that it is a mere hypothesis, is to speak of it too favorably.' And Mr. Stewart, with all his tenderness and partiality towards Leibnitz (for he is half inclined to make him, like Descartes, a sort of father of the experimental philosophy of the human mind), is constrained to say: 'To these visionary speculations of Leibnitz a strong and instructive contrast is exhibited in the philosophy of Locke; a philosophy, the main object of which is less to enlarge our knowledge than to make us sensible of our ignorance; or, as the author himself expresses it, to prevail with the busy mind of man to be cautious in meddling with things above its comprehension; to stop when it is at the utmost extent of its tether; and to sit down in quiet ignorance of those things, which, upon examination, are found to be beyond the reach of our capacities.' It would be well, indeed, if even Mr. Locke had kept this, as well as some other of his sound maxims, more constantly in view; for he, too, not unfrequently proses or philosophises with much profound inanity, or negative quantity of thought, by attempting to go beyond the length of his tether or the reach of his understanding.

'As a metaphysician,' says Mr. Playfair, somewhat satirically, 'the acuteness and depth of Leibnitz are universally admitted; but metaphysics are a science in which there are few discoveries to be made, and the man who searches in it for novelty is more likely to find what is imaginary than what is real.' The only semblance of merit belonging to Leibnitz as a metaphysician is the limitation made by him to the old maxim, descended from some of the Grecian philosophers, Nihil est in intellectu quod non fuerit in sensu. 'Nempe,' says Leibnitz, 'nihil est in intellectu quod non fuerit in sensu, nisi ipse intellectus.' There is nothing in the intellect which was not, or which has not been, in the sense or senses, except the intellect itself. The remark is excellent,' says Mr. Stewart, 'and does honor to the acuteness of the critic;' and, according to others, it threw a new light upon the whole science of metaphysics or philosophy of mind. The incorrectness of the remark, indeed, takes somewhat from its excellence; for how can the intellect be in the intellect? As expressed by Leibnitz the celebrated limitation of the scholastic maxim is a manifest bull. It is, indeed, calculated to call the attention to the intellect or mind itself, which was frequently lost sight of, or which had too little assigned to it, in distinction from the senses, by those who had the maxim about the senses being the origin of knowledge much in their mouth, as if there were nothing but the senses concerned in the business. In reference to Locke, however, the celebrated bull of Leibnitz, of the intellect itself being in the intellect, was not only a blunder in language, but founded in error of conception or a blunder of the understanding; as Mr. Stewart is indefatigable in showing to all the world. His words are, 'The misapprehensions so prevalent on the continent, with respect to Locke's doctrine on this most important of all metaphysical questions, began during his own life time; and were countenanced by the authority of no less a writer than Leibnitz, who always represents Locke as a partisan of the scholastic maxim, Nihil est in intellectu quod non fuerit in sensu; but it is not easy to conceive on what grounds it should have been urged as an objection to a writer who has insisted so explicitly and so frequently on reflection as the source of a class of ideas essentially different from those which are derived from sensation. To myself it appears, that the words of Leibnitz only convey, into a more concise and epigrammatic form, the substance of Locke's doctrine. Is any thing implied in them which Locke has not more fully and clearly stated in the following sentence? 'External objects furnish the mind with the ideas of sensible qualities; and the mind furnishes the understanding with ideas of its own operations.' The extraordinary zeal displayed by Locke, at the very outset of his work, against the hypothesis of innate ideas, goes far to account for the mistakes committed by his commentators, in interpreting his account of the origin of our knowledge. It ought, however, to be always kept in view, in reading his argument on the subject, that it is the Cartesian theory of innate ideas which he is here combatting; according to which theory, as understood by Locke, an innate idea signifies something coeval in its existence with the mind to which it belongs, and illuminating the understanding before the senses begin to operate. The very close affinity between this theory and some of the doctrines of the Platonic school prevented Leibnitz, it is probable, from judging of Locke's argument against it with his usual candor; and disposed him hastily to conclude that the opposition of Locke to Descartes proceeded from views essentially the same with those of Gassendi and of his other Epicurean antagonists. How very widely he was mistaken, in this conclusion, the numerous passages which I have quoted in Locke's own words sufficiently demonstrate.

'In what respects Locke's account of the origin of our ideas falls short of the truth will appear when the metaphysical discussions of later times come under our review. Enough has already been said to show how completely this account has been misapprehended, not only by his opponents but by the most devoted of his admirers; a misapprehension so very general, and at the same time so very obviously at variance with the whole spirit of his essay, as to prove to a demonstration that, in point of numbers, the intelligent readers of this celebrated work have hitherto borne but a small proportion to its purchasers and panegyrists. What an illustration of the folly of trusting, in matters of literary history, to the traditionary judgments, copied by one commentator or critic from another, when recourse may so easily be had to the original sources of information.'

Mr. Stewart is unwearied in vindicating Locke on this point: or rather in claiming the sanction of Locke's authority to what he deems the 'most important of all metaphysical questions.' It is such a good thing that the critic thinks there cannot be too much of it: he loves the theme so much as to be ever ringing changes upon it. Whether he and Mr. Locke, however, mean the same thing respecting the 'most important of all metaphysical questions' is very doubtful; and that Mr. Locke very frequently lost sight of any origin of ideas besides the senses, as completely as Gassendi or Epicurus, is to us very evident. How else is it to be accounted for that Mr. Locke's opponents or admirers should have equally, almost universally and uniformly, misunderstood him, according to Mr. Stewart's own account of the matter? Are they all to be charged with want of intelligence or with wilful and perverse misinterpretation? We requote a quotation of the critic's from Degerando, which, as he remarks, 'might furnish matter for some useful reflections, but I shall leave my readers to draw their own conclusions from it.' 'Another remarkable circumstance,' says Degerando, 'is, that the defence of the Kantians turned, in general, not upon the truth of the disputed proposition, but upon the right interpretation of their master's meaning; and that their reply to all objections has constantly begun and ended with these words, 'You have not understood us.' The constant reply of Mr. Stewart to the opponents, and to the disciples of Locke, concerning his doctrine respecting the origin of ideas, is 'You have not understood him.' It recurs, and recurs in endless succession, as if by some metaphysical law of continuity.

Having dwelt much longer on Leibnitz than we intended, we may as well dispose of German metaphysics at once by some notice of Kant: though it is not without some reluctance that we notice him at all, or give any place to a mere specimen of his absurdities, which possess not such redeeming qualities as those of Leibnitz; for they are as devoid of genius as they are of sense or reason. The following extracts are inserted from a publication of his humble disciple, and enthusiastic, and adoring, admirer, Thomas Wirgman, modestly entitled 'An Entirely New and Complete Science of Metaphysics, founded on Transcendental Philosophy.'

Metaphysics Reduced to a Complete Permanent Science, on the Principles of Transcendental Philosophy, as contained in Kant's Critic of Pure Reason.

'1. The mind consists of three original faculties which perform distinct functions, and are capable of being completely separated from one another; these are, sense, understanding, and reason. 2dly, Sense is susceptible of a complete definition, whereby it can never be confounded either with understanding or reason: it is the passive faculty of the mind, which receives impressions either from external objects or from the action of the mind upon itself, and is properly enough designated by Kant receptivity, which is again divisible into two parts arising from the original difference in the functions of these parts: the one Receptivity being constructed to receive parts following one another in strict succession, arising from the activity of the mind upon itself; which has received the name of time; the other being constructed to receive parts that exist all at once, or that lie one near another as in a plane, and is named space. 3dly, Understanding, which is wholly active, and therefore called spontaneity; and is divisible into twelve minor activities called categories, whose joint influence or action upon the matter furnished to them by the receptivities of sense produces an objective unity, i. e. in fact, an object, or, as it is commonly called, an object of sense. The action of this faculty is strictly limited to time and space. Whatever therefore is without the bounds of time and space, and yet occurs in the mind, must be accounted for from some other faculty; which leads us, 4thly and lastly, to reason, or the highest degree of mental spontaneity. The original constitution of this faculty is that it acts free from time and space. It is, in fact, a connecting activity, like that of the intellect or understanding, only of a purer nature, for it connects the categories themselves, which surely cannot now be confounded with the two receptivities of sense, time, and space; it must therefore be free from them, and out of their sphere. Hence the result of the action of this faculty is, a connexion of unities so pure, as not to be denominated objects of sense, but solely intellectual objects, and which never can become objects of experience; they may, therefore, very properly be termed ideas: such are the ideas of God, of the soul, of free will, of a future state, and of the moral laws, which experience, i. e. natural philosophy or physics, can never furnish; but, if they are to be met with at all, it will be in the science of metaphysics, that is, of reason itself.

'Transcendental philosophy has for its object the original use of understanding and reason in begetting knowledge. This science is completely à priori, and has nothing in it empirical. On this science alone rests the possibility of metaphysics.

'Metaphysics consider the categories, or original conceptions of understanding, as the last or highest conceptions to be found in the things, or as conceptions à priori of the things; and are divisible into metaphysics of nature and metaphysics of morals. The former comprehend the complex of all knowledge à priori, of that which does exist; and is theoretical. The latter con-

prehend the complex of all moral conceptions, or of all that which ought to exist; and is practical.

All philosophy that is à priori may be termed pure, in contradistinction to physics, or natural philosophy, which is à posteriori, and may be termed empirical.

The certainty and conviction that are found in the pure sciences of transcendental philosophy and metaphysics are obtained by the categorical mode of conclusion: in the mathematics by construction of the conceptions, which therefore admits of demonstration; while the certainty in the empirical science of natural philosophy can only be obtained by induction and analogy: modes of conclusion which can never beget strict universality.

But now let us see what our patient and modest philosopher says upon this subject in his own words. In the preface to his Prolegomena to all future Metaphysics, he speaks thus:—

'My intention is to convince all those who think it worth their while to occupy themselves with metaphysics, that it is indispensably necessary to suspend their labors for the present; to consider every thing hitherto done, as undone; and first of all to settle the question, whether such a thing as metaphysics be possible? If there really be such a science, how comes it that it cannot obtain, like other sciences, a universal and permanent reputation? If metaphysics be not a science, how does it happen that it continually pretends to this character, and yet constantly disappoints the human understanding with perpetual but unaccomplished hopes? Let us then demonstrate either our knowledge or our ignorance on this subject; something decisive ought to be determined with respect to the nature of this pretended science: for it must not be suffered to remain any longer in its present state. It seems quite ridiculous that, while every other science constantly advances, this science, which is universally appealed to as the oracle of wisdom itself, has always turned round upon the same spot, and never really advanced a single step. The patrons of metaphysics are indeed greatly decreased in number; and we do not find that those who feel themselves strong in other sciences choose to venture their reputation in this, where every one, no matter how ignorant in other things, boldly ventures upon a decisive judgment; conscious, as it should seem, that no criterion has yet been discovered to distinguish sound sense from shallow prating.

'However, it is not a thing so very unheard of, that after long cultivating a science, and while we are congratulating ourselves on our astonishing advancement in it, some one unexpectedly starts the question, whether such a science be really possible? For human reason is so fond of building, that it has frequently erected its castle, and then had to take it to pieces again, in order to examine the foundation. It is never too late to become rational; but it is hard to have this task to begin at an advanced period of life.

'To ask if a science be possible, implies that one doubts of its reality; and such a doubt is highly offensive to those whose whole treasure consists perhaps in this pretended knowledge. They will prepare, therefore, on all sides, to defend their ancient and legitimate possessions.

'I have, however, the confidence to predict that such readers of these prolegomena as think for themselves, will not only be convinced that no science of metaphysics exists at present, but that there never can be such a science, unless the requisites here stated, upon which its possibility rests, be first complied with. As, however, the enquiry respecting this science can never be entirely laid aside, because the interest of human reason is too intimately connected with it, they will see that a complete reform, or rather an entire regeneration, of metaphysics, on a plan hitherto untried, must unavoidably take place, however it may be for some time struggled against.

'Since the attempts of Locke and Leibnitz, or indeed since the origin of metaphysics, as far as its history reaches, no event has occurred so calculated to decide the fate of this science as the attack made upon it by Hume. He brought, it is true, no light into this department of knowledge; but he struck a spark, which, had it fallen upon combustible matter, and been carefully fanned, might have produced a flame. Hume took up a single but important conception of metaphysics; namely, that of the connexion of cause and effect (consequently the derived conceptions of power, action, &c.); and challenged reason, which holds it up as its own produce, to say by what right it concludes, that one thing may be so constituted, that if it be given, something else must necessarily be inferred; for this is the meaning of the conception of a cause. He proved, beyond contradiction, that it is quite impossible for reason to discover in the conceptions themselves any such necessary connexion, since we cannot see why, because something is, something else must also necessarily be; and consequently we are at a loss to know how the conception of such a connexion à priori can have arisen. Hence he concluded that reason entirely deluded itself with this conception, falsely considering it as its own offspring, while in fact it is nothing more than a bastard of the imagination, which, being made pregnant by experience, has brought certain representations under the law of association, and substituted a sort of subjective necessity, namely, habit, for an objective one, founded upon real knowledge. He concluded, therefore, that reason had no faculty to think such connexions even generally, because its conceptions would in that case be mere fictions, and all its pretended knowlege à priori nothing but a false value given to common experience. In other words, that no such science as metaphysics is at all possible.

'Notwithstanding this rash conclusion, however, Hume calls his very destructive philosophy by the name of metaphysics, and sets a great value upon it. 'Metaphysics and morals,' says he, 'are the most important branches of science; mathematics and natural philosophy are not of half the value.' This acute man, however, looked merely to the negative advantage, which would arise from lowering the pretensionsof speculative

reason, and quieting the disputes of men. But here he lost sight of the positive harm which would occur, were reason deprived of its most important prospects, which alone hold out to the will the highest object of all its exertions.

'Yet, however hasty and incorrect his inference was, it was grounded at least upon investigation; and this investigation certainly deserved that the philosophers of his day should have united their endeavours to solve, if possible, his problem in the sense in which he delivered it; and, had they succeeded in this, an entire reform of the science would have immediately followed. It was, however, the fate of metaphysics, ever unfortunate, that no one should understand Hume's intention. It is painful, indeed, to observe how entirely his opponents, Reid, Oswald, Beattie, and Priestley, missed the point of his question, always admitting, as a matter of course, the very thing which he doubted, and proving with vehemence, and mostly with great indiscretion, that which it never entered his mind to doubt. They thus overlooked his hint at improvement, and suffered every thing to remain in its original state, as if nothing had happened. The question was not, whether the conception of cause be correct, useful, and indispensable, to all knowledge of nature; for this Hume never doubted? but whether this conception be thought by reason à priori, and whether it possess, on that account, an internal truth, independently of all experience, and therefore a more extensive utility, not limited merely to objects of experience. It was of this great problem that Hume sought the solution. His enquiry regarded merely the origin of the conception of cause, and not its indispensability in the application. Had its origin but once rightly been made out, the conditions of its use, and the extent of its validity, would have become evident of themselves.

'But, in order to solve this problem, the opponents of this celebrated man would have been obliged to enter very deeply into the nature of reason, as it is occupied with pure thinking, which was not quite convenient to them. They therefore invented a more ready means of attack and defiance, which required no such deep insight; they appealed to common sense. Certainly it is a great gift of heaven to possess common sense, or, as it is sometimes termed, a plain understanding. But we must prove that we possess it by facts, by the considerate and rational things which we think and say, not by the mere appeal to it as an oracle, while we can produce nothing in its justification. When our philosophy and science begin to fail, to appeal then, and not till then, to common sense, is one of the subtle inventions of modern times, by which the shallowest prater may boldly cope with and maintain himself against the deepest thinker. But, while the smallest spark of true philosophy remains, I have no doubt that we shall be cautious of taking refuge in this expedient. The appeal to common sense is, after all, but an appeal to the opinion of the multitude; which the philosopher must blush to make, but on which the popular witling gladly sounds his momentary triumph.

'I should conceive, however, that Hume might lay claim to a sound understanding just as well as Beattie; and, besides this, to something that the latter certainly did not possess; namely a critical reason, which knew how to keep common understanding within its proper bounds, and to prevent its losing itself in speculations; for common sense does not understand the principles on which it acts, and therefore cannot know when it is sound and when not. A common hatchet may serve very well to shape timber, but a more delicate instrument is required for fine engraving. Thus the common understanding, and the speculative, are both useful in their way; the one in judgments immediately applicable to experience, the other in general judgments, as in metaphysics, where common sense cannot judge at all.

'I candidly own that this hint of David Hume was the circumstance that first disturbed my dogmatical slumbers, and gave a new direction to my researches, in the field of speculative philosophy. I was far from listening to his inferences, which proceeded merely from his own representing to himself his problem in its whole extent, but investigating merely a part of it, the solution of which was impossible without a comprehensive view of the whole. When we proceed upon a well-grounded, though not thoroughdigested, thought, we may reasonably hope, by perseverance, to carry it further than the acute genius to whom we are indebted for the first spark of this light.

'I first examined whether Hume's objection might not be rendered a general one; and soon found that the idea of cause and effect is by no means the only one in which the understanding represents to itself a connexion of things à priori, but that the whole of metaphysics consists of nothing else. I endeavoured to ascertain their number; and, having done this to my satisfaction upon a single principle, I proceeded to the deduction of these conceptions. I now saw, very clearly, that they were not derived, as Hume had supposed, from experience, but originated in the understanding itself. This deduction, which appeared impossible to my acute predecessor, and which had never even entered the mind of any one else (for although every body used these conceptions, no one thought of enquiring upon what their objective validity is founded);—this deduction, however, was the most difficult task that could be undertaken for the establishment of metaphysics; and to this, unfortunately, no existing metaphysics could afford the smallest aid; for it is this very deduction which must first constitute the possibility of metaphysics itself.

'Having thus succeeded in the solution of Hume's problem, not merely in a partial view, but with reference to the whole faculty of pure reason; I could now proceed, by safe, though indeed slow, steps, to determine completely, and upon general principles, the entire compass of pure reason; to ascertain its limits, and the sphere of its exertion. This, indeed, was all that was required for erecting a system of metaphysics upon a proper and solid foundation. But I am aware, that the solution of Hume's problem in its entire extent (in other words, the 'critic' of

pure reason itself) may have the same fate as the problem. It will be judged of incorrectly, because it is not understood; it will be misunderstood, because men are more disposed to turn rapidly over the leaves of such a book than to study it thoroughly. It will be thought dry and obscure, and be found to contradict all the received conceptions: and, besides this, it will be considered prolix.

'I freely confess that I did not expect to hear philosophers complain of the want of popularity and entertainment, in a work that treated of the existence of a valuable branch of knowledge, of a science indispensable to mankind, and which can only be attained by an adherence to the strictest rules of scholastic precision. It may indeed hereafter become popular; but it must not make its first appearance in a popular shape. That obscurity, however, which may have arisen from the extensiveness of the plan, rendering it difficult to seize and comprehend the chief moments upon which it rests, it is the object of the present prolegomena to remove.

'The work which contains the science of the faculty of pure reason, in its whole extent and boundary, must always be considered as the object to which these prolegomena refer, merely as previous exercises. The 'critic of pure reason' must stand firm as a system complete in all its parts before we can think of advancing one step in metaphysics, or even entertaining the most distant hope of such a science.

'We have been so long accustomed to see old and hackneyed observations brought out with a new title, and dressed in a systematic costume, according to the fancy of authors, that nothing further will be expected by the greater part of readers in the 'critic of pure reason.' These prolegomena, however, will show, that it contains an entirely new science, of which no one had previously conceived the thought, and to which nothing hitherto known could at all contribute, except the hint afforded by the doubts of Hume, who himself, however, did not foresee the possibility of such a formal science, but in his distress, in order to save his vessel, ran her upon the shore of scepticism, there to lie and rot; instead of which it has been my business to provide her a pilot, furnished with a complete chart and compass, who shall be able to navigate her safely round the world.

'To enter upon a new science which is entirely separated from all others, and indeed the only one of its kind, with this prejudice, that we are already able to decide upon it by means of knowledge elsewhere acquired (though, in fact, the truth of this pretended knowledge is the very thing in question), can tend to nothing else than to make us imagine all we find in it has been previously known to us, because, perhaps, some of the expressions have been used before. The whole will, however, appear extremely disfigured, nonsensical, and in fact mere gibberish, because we do not take the thoughts of the author as his foundation, but substitute our own in their stead, which in us have become a second nature through long habit. However, the very extensiveness of the work, even where it depends upon the nature of the science itself, and not upon mere style; its unavoidable dryness and scholastic precision; are properties which, while they contribute to the perfection of the science, will undoubtedly be injurious to the reception of the work itself.

'Every one is not endowed with the gift of writing so subtilely, and at the same time in so captivating a manner, as Hume; or so soundly, and yet so elegantly, as Moses Mendelsohn; I flatter myself, however, I could have given popularity to my style, had it been my design merely to form a plan and recommend its execution to others, and had I felt less at heart the good of the science which has so long occupied me. It does indeed require great perseverance, and no little self-denial, to give up the gratification of an immediate favorable reception for the prospect of a late, though lasting, approbation.

'To form plans is frequently a mere luxurious and ostentatious employment of the mind, which, with the air of an inventive genius, requires what it is unable to perform, censures what it cannot amend, and sets others upon the search for what it does not itself know where to find. Nevertheless, to form a good plan merely of a general critic of reason requires something more than may be imagined, unless indeed it is to consist, as is usually the case, of mere declamation and good wishes. Pure reason is so insulated, and so thoroughly connected within itself, that we cannot touch upon a single point without affecting every other, and can establish no one part permanently without assigning to every other its proper place and influence upon the whole; for, as there is nothing exterior to this science that can assist in rectifying our judgment concerning its contents, the validity and the use of every part must depend entirely upon the relation in which it stands to the rest; just as, in examining the structure of an organised body, the use of each organ can only be inferred from a complete conception of the whole. Hence we may say, of a critic of pure reason, that it cannot be relied upon unless it be completely elaborated to its minutest elements; and therefore, that, if the whole is not accomplished, we have done nothing at all.

'Notwithstanding, however, that such a plan, were it possible that it could have appeared prior to the critic itself, would have been unintelligible and useless, yet, coming after the critic, it is of the greatest advantage, since it will enable us to overlook the whole, and to examine separately the principal points upon which it depends.

'The plan which I here offer succeeds to the work itself, and may therefore proceed now according to an analytical method, though the original work was formed synthetically, as indeed it was necessary that it should, in order that the science might exhibit all the articulations in the organisation of this peculiar faculty of knowledge. Those who find even this plan obscure, which I here place as an introduction to all future metaphysics, should consider, that it is not exactly necessary for every one to study metaphysics; that many men possess talents, well calculated to succeed in useful and even difficult sciences, which come nearer to intuition; but fail in enquiries that relate to mere abstract con-

ceptions; and that it is better for them to apply their intellectual exertions to other objects. But he who shall hereafter undertake to decide upon, or to construct, a new system of metaphysics, must absolutely satisfy those demands which are here made upon it. He must either adopt my solution, or refute it altogether, and substitute another in its place; from this he cannot be excused.'

We feel that these extracts are abundant; but must not omit the following method of *simplifying* the science adopted by this school:—

ELEMENTS OF METAPHYSICS.

INTUITION,	CONCEPTION,	IDEA,
present in Time and Space.	absent in Time and Space.	out of Time and Space.

THE

MIND.

SENSE.

Two receptivities.

Time. Space.

UNDERSTANDING.

Twelve Categories.

Quantity.	*Quality.*	*Relation.*	*Modality.*
Unity,	Reality,	Substance and Accident,	Possibility,
Multitude,	Negation,	Cause and Effect,	Existence,
Totality	Limitation.	Action and Re-action.	Necessity.

REASON.

Six ideas.

Absolute Totality.	Absolute Limitation.	Absolute Substance,	Absolute Necessity.
		Absolute Cause,	
		Absolute Concurrence.	

Axioms of Metaphysics.

1. Consciousness is the power to distinguish ourselves from surrounding objects and from our own thoughts.
2. Time is the form of internal sense.
3. Space is the form of external sense.
4. Sense makes Intuitions.
5. Understanding makes Conceptions.
6. Reason makes Ideas.

Definitions.

1. Intuitions joined to conceptions make knowledge.

2. Conceptions joined to conceptions make thoughts.

Remark.—The above axioms originate in transcendental philosophy, on which the possibility of metaphysics as a science rests.

As the preceding table exhibits the entire elements of metaphysics, it is only requisite, for the establishment of the science, to give a complete explanation of each part, and to prove that these elements are neither deficient nor redundant.

The Mind

1. The mind, in the most extensive meaning of the word, implies a faculty of representing something to itself: and therefore may be termed a representing faculty,

Proof.—In every thought, conception, knowledge, judgment, idea, &c., the mind always represents some object to itself; or the thought, conception, &c., is perfectly empty, and completely senseless.

2. Every representation requires a representing subject and a represented object.

Proof.—The representing subject, by acting upon the object that has occurred in the mind, produces the representation. The subject and object taken together are the cause, and the representation is the effect. And no representation whatever is possible without these three parts: that is to say, subject and object as cause; and representation as effect.

3. In every representation, thought, conception, knowledge, &c., there must be an object consisting of parts; and these must be united into a whole.

Proof.—For that which hath no parts is absolutely nothing, and therefore cannot be representable as an object; and, unless these parts are connected into a whole, or unity, no representation of any one thing would be possible.

Sense.

1. Sense is the passive faculty of the mind, that receives the parts of which the object in the representation consists, and connects them into a whole, or unity, which is called intuition.

Proof.—For, if sense do not receive the parts of which the object or matter of every representation consists, then we create the objects, which is absurd. And until these parts are connected into a whole, or unity, no object could occur in a representation.

Explanation of terms employed in the science of metaphysics.

Sense in its passive capacity is called receptivity; for it receives the variety or matter of all representations which the mind could not create.

Sense in its active function is called spontaneity of the first degree, as merely uniting the parts which are received by the mind into that species of unity which is called intuition.

Remark.—An intuition is not an intelligible object, for the intellect has not yet operated upon it; still we are conscious of the presence of an object, though we do not know what it is.

2. As sense receives, it is clear that it must receive a variety of parts, otherwise it has nothing at all to receive. Now there are only two general varieties, the one whose parts co-exist, the other whose parts are in strict succession.

Proof.—All objects in space have their parts co-existing; all objects which are in time only, have their parts following one another. The former comprehend all external sensible objects; the latter the effects and relations of these external objects, or the internal sensible state of the subject. But these two descriptions include every possible object.

3. As the receptivity of sense receives objects, the parts of which are either co-existent or successive, it may be divided into two parts.

Remark.—This division is not only very natural, but it is also indispensable; for, without it, we should be unable to give accurate definitions of time and space.

4. The receptivity which receives an object whose parts co-exist is external receptivity, or space.

Proof.—For, when we analyse our notion of space, we find it to consist of a variety of co-existing parts, connected together into a unity. But space alone is that whereby an object consisting of a variety of co-existent parts can occur; which is precisely the case with the external receptivity; therefore space is external receptivity.

5. The receptivity which receives an object whose parts are successive, that is, merely the effect of some external object; and which, therefore, exist in time only, and can only be an internal object; is internal receptivity, or time.

Proof.—For, when we analyse our notion of time, we find it to consist of a variety of parts in strict succession, connected together into a unity; and time is that alone wherein an object consisting of a variety of parts in succession can occur; which is precisely the case with internal receptivity; therefore time is internal receptivity.

Explanation of terms.

Sensation is an alteration which takes place when the receptivity is affected, and is the ground of intuition.

Intuition is a sensible representation which arises immediately upon the receptivity being affected, and is either external intuition, when its object is in space, that is, an external phenomenon; or internal intuition, when its object is in time only; that is, an internal phenomenon, or the effect of an external one.

Phenomenon means appearance, and is used to distinguish the object in the representation from the object out of it, which is its cause, and is called noumenon.

Noumenon is the thing in itself, that is, independent of our faculties; for it is then out of time and space; that is, out of the sphere of knowledge. Of noumena, therefore, we can know nothing.

Conclusion.—Thus we have seen that the mind is both active and passive. Its receptivity receives the matter of knowledge, which it could not create. Its spontaneity connects this matter into a unity or form, and thus produces an intuition. Hence, sense or the first degree of spontaneity, constitutes the power of forming intuitions.

Understanding.

1. Understanding is an active faculty, a spontaneity of the second degree. It comprehends an intuition under a conception, or under the objective unity; that is, renders it an intelligible object.

Proof.—For, until an object is classed by the understanding, it is a mere intuition, or an unintelligible object; but, the instant the intellect has operated upon it, it becomes intelligible; I may then say I understand it, and know what it is.

2. To render an object intelligible is to give to it a precise quantity, a particular quantity, a determinate relation, and a distinct degree of certainty, called modality.

Proof.—For that thing which has no precise quantity, e. g. that is neither a mathematical point nor an entire world, nor any part of a world; and which has no particular qualities, e. g. is neither hard, soft, &c., and which stands perfectly alone, without any relation to other things, neither being a body, nor an effect of a body, nor a part of a whole; is completely unintelligible.

3. The understanding consists of twelve primary and original connecting acts called categories, and classed under the four heads of quantity, quality, relation, and modality.

Remark.—The whole fabric of metaphysics either stands or falls upon the proof of this position, which will be given in the sequel, under each head as it arises; and, should it fail, then indeed will metaphysics be thrown into the utmost confusion, and be again the stumbling-block of the learned; but should it succeed, as it is presumed it will, we may then boast, that at length metaphysics has become a science which surpasses geometry, since it explains what the geometrician always assumes or takes for granted,

namely, his axioms, together with time and space.

4. Quantity consists of unity, multitude, and totality; and must belong to every thing.

Proof.—For that which is without quantity, that is to say, which is neither one, many, nor all, is no intelligible object; consequently not representable: i. e. it is nothing.

5. Quality consists of reality, negation, and limitation; which means that a thing either is, or is not; and, if it is, that it is limited

Proof.—To say that a thing is, and yet is not a real thing, is to contradict ourselves. And to say that there can be any real thing, and yet without limits, is certainly going beyond the bounds of intelligibility, which confines to limits; for we know nothing of the infinite.

6. Relation includes only that of a substance to its properties, of a cause to its effect, or of action to re-action.

Proof.—For, when we examine really existing things, we find they stand in relation to other existing things; and without such relation they are by no means conceivable; e. g. we cannot conceive a substance without its properties, a cause without its effect, or a whole without its parts.

7. To constitute an intelligible object means to comprehend the intuition produced by sense under the objective unity; i. e. to judge.

Proof.—For, until an intuition is comprehended under the objective unity, it is perfectly unintelligible. That is to say, that the understanding, by classing an intuition under quantity, quality, and relation, constitutes the intelligibility of the given matter or object in the intuition; so that it perfectly harmonises with the fact to say, that sense receives the matter of all knowledge, and understanding produces its form.

8. An intuition united to a conception produces knowledge.

Proof.—It is evident that knowledge cannot consist of mere conceptions united together; for I cannot say, because I conceive a certain thing, that I therefore know it; but, the instant I class a particular intuition under a certain conception, I can say I know it; e. g. This building is a castle.

9. Modality consists of possibility, existence, and necessity. This expresses the mode or manner in which the intuition belongs to time; namely, it may be in any time, or it is in a certain time, or it must be in all time.

Proof.—Nothing can be more evident than that an intuition may be possible; that is, such that it may exist in any time; or it may be actual, that is, really exist in a certain time; or it may be necessary, that is must exist in all time; as the very contrary is impossible, e. g. a circle without a centre.

10. The twelve categories of the understanding, as arranged under the four heads of quantity, quality, relation, and modality, are not only essentially necessary to the intelligibility of objects of sense, but they are actually complete in their number, that is, neither deficient nor redundant.

Proof.—It is quite impossible to add one more category to the understanding; and, if we take one away, the whole faculty will be destroyed. For, if we speak of a number, it must either be one, many, or all; and no other case is possible. Secondly, if we have any thing in our thoughts, it must be a reality, or the absence of a reality; but, if a reality, it cannot be infinite, therefore it must be limited by negation; that is, there may either be a reality or no reality; but, if there be a reality, it must be limited; and no other case is possible. Thirdly, We can only be affected by things and their properties, by causes and their effects, or by parts and their wholes. Nothing more than this is conceivable, therefore much less knowable; for experience consists entirely of these relations. Lastly, With respect to modality; things may either be in any time, that is merely possible; or in a certain time, that is actual; or they may be in all time, and to be destroyed only with the destruction of time, that is, they may be necessary. Of this nature are the categories themselves, for without them there could not possibly be any experience whatever.

Explanation of Terms.

Quantity is that which is produced by adding one to one; and expresses the conception of a number in general.

Quality is the quantity of being in time; for every sensible reality has a being in time, that is, a beginning, middle, and end. But this series of sensations can only be measured by a degree; therefore quality is expressed in our conception of a degree in general.

Substance is that which lasts in time, and has properties that change; or it is the permanent in space, in which the properties or accidents inhere.

Cause is a power in one substance to act upon another, and thus to produce a third thing called effect. The first substance, or intuition is called the subject or agent; the second or substance intuition is called the object, or patient, being the thing acted upon; and thence arise necessarily and immediately the effect. Hence cause may be defined to be the action of the subject upon the object, whereby the effect is produced. Cause precedes in time, and effect succeeds; but not vice versâ.

Concurrence means the mutual action and reaction of co-existing substances or intuitions, whereby one determines the other's place in space, and vice versâ, as parts of a whole.

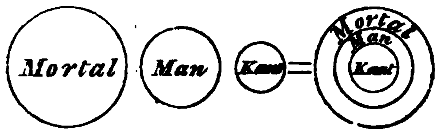
Conclusion.—Thus we have shown that the understanding is purely an active faculty which gives unity or form to the matter received by sense; that is, renders an intuition an intelligible object. This faculty is therefore a spontaneity of the second degree, but strictly limited to time and space; or it is the power of forming conceptions.

REASON.

1. Reason is an active faculty, or spontaneity of the third or highest degree. It comprehends a conception together with its intuition, under an idea, and thus renders a conclusion possible.

Proof.—For what is a conclusion, but the comprehending the individual under the particular, and this under the universal? as illustrated by the following figure:—

Idea Conception Intuition



Totality Multitude Unity

Hence the conclusion; therefore Kant is mortal. But how could a conclusion take place without a faculty capable of producing an absolute totality, or a totality free from time and space, and which admits of no exceptions whatever? If the highest conception of idea in a ratiocination were particular, instead of universal, no conclusion would be possible. But of the fact of conclusion no one doubts; therefore the faculty to produce it must be admitted.

2. To render an object comprehensible is to class it under an idea of reason, or under a conclusion.

Proof.—If the intuition Kant were only classed under a conception of understanding, it would then be an intelligible object, but limited in all respects as to its duration and every other property; for, as an object of experience, it would only be necessary on account of its cause; and we could not predicate of it any thing absolutely; but, reason being a faculty that acts free from time and space, and their conditions, it enlarges our views by allowing what the understanding has done, and yet hinting that this does not include all the properties of which objects of nature are possessed, that they may have a nature of their own, independent of that connected with our mode of representing them; but this it can only do by classing the object under an idea: hence the judgment, all men are mortal.

3. Reason is only capable of exerting three modes of concluding; namely the categorical, the hypothetical, and the disjunctive.

Proof.—For this faculty can only arrange ideas of things and their properties by its categorical concluding act; causes and effects by its hypothetical; and parts and wholes by its disjunctive concluding act. But besides things and properties, causes and effects, and parts and wholes, there are no other things in the whole universe the ideas of which reason could arrange one under another. Therefore there are no other concluding acts but the categorical, hypothetical, and disjunctive.

4. Reason arranges the categories of quantity one under another, thus: unity under multitude, and these under totality; and thereby produces the idea of absolute totality.

Proof.—Every thing connected by the understanding is strictly limited. But we really have the idea of something which goes far beyond the limited things of nature; and the only way in which this idea is obtained is by a conclusion of reason; for it is evident that the categories unity, multitude, and totality, are themselves unconditioned things, and that, being connected into a unity by reason, this unity must also be absolute or unconditioned. Thus reason will have absolute completeness; and, when this mode of action is applied to the other categories, the following ideas result.

5. Reason connects the categories of quality—which are reality, negation, and limitation, into the idea of absolute limitation.

Proof.—For every reality in time and space is limited by negations. It is a variety whose parts can be measured by degrees only, and these by other degrees still smaller; and this without end. But reason will have absolute completeness, and thus forms the idea of absolute limitation.

6. Reason connects the categories of relation, which are each of them already compound notions, into the following ideas.

First, substance and accident into the idea of absolute substance.

Proof.—For all the substances in the world are nothing more than a collection of properties existing in time and space; and every analysis of these substances only produces another set of properties without end; but reason, which acts free from time and space, and will have absolute completeness from the category of substance and accident, raises the idea of an absolute substance, which can never again become a predicate of any other substance.

Secondly, Cause and effect into the idea of an absolute cause.

Proof.—For all he causes in time and space are nothing more than effects from preceding causes, and these causes are again effects of other causes ad infinitum. But reason, which will have absolute completeness in a series of causes and effects, raises to itself an idea of an absolute cause which cannot be the effect of any other cause.

Thirdly, Action and re-action into the idea of absolute concurrence.

Proof.—For all the substances in the world are endowed with causes which work upon other substances, and thus mutually determine each other's place in space. All these substances are themselves only effects of other substances, and so on ad infinitum. But reason, which acts free from time and space, will have an absolutely complete series of causes and effects, and thus raises the idea of absolute concurrence.

Remark.—The most important notions that concern us, as accountable beings, depend entirely upon this peculiar faculty of reason in raising these ideas. For how otherwise could we obtain the idea of our own soul, a first cause, or the deity? and without these notions we should not differ from the brute creation, and must for ever give up our claim to the rank of rational beings. It may further be remarked that the sciences of psychology, cosmology, and theology, have their roots in these important ideas of reason. For the idea of absolute substance leads to psychology, the idea of a first cause leads to cosmology, and the idea of an absolute mutual concurrence leads to the science of theology.

7. Reason connects the categories of modality, which are possibility, existence, and necessity, into the idea of absolute necessity.

Proof.—For in time every change is determined by a preceding change, and consequently there is no absolute necessity. But reason, which acts free from time, forms an idea of something which

does not depend on a preceding change, and which is exempt from the conditions of time; hat is, an idea of absolute necessity.

Conclusion.—Thus we have shown that reason, or the highest degree of spontaneity, is an active faculty of so pure a nature as to be able to connect parts which are already out of time and space into wholes called ideas. For what are the categories of understanding, but parts of this description? On these ideas is founded the erroneous notion, that we can know immaterial existences; whereas we can only have ideas of them. Hence reason, or the third degree of spontaneity, is the power of forming ideas.'

Mr. Horne Tooke, having made some quotations from Mr. Harris and lord Monboddo, exclaims, with too much levity perhaps, 'If this be philosophy, give me back my Tom Thumb again.' But what shall we say to the 'critic' of pure reason? If this be transcendental philosophy, give us back the philosophy of Aristotle again; for, taking chimera for chimera, as Gassendi said of the vortices of Descartes and the atoms of Epicurus, we cannot help having some partiality for the one that is 2000 years older than the other. According to Dr. Willich 'The whole critique of pure reason is established upon this principle, that there is a free reason independent of all experience and sensation.' If we may believe madame de Staël this notable critique of pure reason is to be regarded 'as having given the impulse to all that has since been done in Germany both in literature and philosophy; but, according to the respectable testimony of Degerando, a pure Kantian is not to be found at present in Germany. 'In short,' he remarks, 'the Critique of Pure Reason, announced with pomp, received with enthusiasm, disputed about with fury, after having effected the overthrow of the doctrines of Leibnitz and Wolff, could no longer maintain itself, and has produced no permanent result but divisions and enmities, and a general disgust towards all systematic creeds.' But enough and more than enough.

'Indignandum de isto, non disputandum est. * * * Quid te torques et maceras, in ea quæstione quam subtilius est contempsisse quam solvere?' How applicable is the import of these quotations to many more than Kant, who is indeed a most worthy successor of Leibnitz, and a fit specimen of German philosophers.

LOCKE.

Having attempted to clear away some metaphysical rubbish, we now return to the celebrated author of the Essay concerning Human Understanding; a work which we think with Mr. Stewart has been much more applauded than read. Indeed much of the applause, we suspect, is owing to the very circumstance that it has been little read; and, if there be any truth in Voltaire's criticism on Dante, the praise of Locke is likely to continue and increase 'aye more and more;' for it may now almost be said that nobody reads him. This we feel confident of, that many of his most zealous eulogists, who have the phrases the great Locke, the immortal Locke, ever and anon in their mouth, never carefully read his great work. We have read it, and re-read it, and attempted inwardly to digest it; but we have all ways found it a laborious task, and we fear that either our digestive system is indifferent, or that much of the Essay concerning Human Understanding is not very convertible into intellectual aliment. That there are some things in it 'hard to be understood' is evident from the very circumstance so much and so often insisted on by Mr. Stewart, as already noticed. This unintelligibleness we think attributable to the following causes:—

1. Mr. Locke, notwithstanding all his sage remarks on the folly of meddling with things above the comprehension of the understanding, is ever and anon attempting to sound depths too profound for the length of his line; or rather he plunges headlong into the abyss and chaos of scholastic subtleties. This is particularly the case in much of Book II., in not a little also of Book IV., as well as in other parts of the essay. It may seem strange indeed that Mr. Locke should have fallen into this error; but it only proves that philosophers, like other men, often transgress against their own maxims, not only in the conduct of life (as in the case of the philosopher so strikingly depicted by Johnson in his Rasselas) but in the conduct of their understanding—even in their speculations. What can be more judicious than the following remarks of Mr. Locke? 'If, by this enquiry into the nature of the understanding, I can discover the powers thereof; how far they reach, to what things they are in any degree proportionate, and where they fail us; I suppose it may be of use to prevail with the busy mind of man to be more cautious in meddling with things exceeding its comprehension; to stop when it is at the utmost extent of its tether; and to sit down in a quiet ignorance of those things which, upon examination, are found to be beyond the reach of our capacities. We should not then perhaps be so forward, out of affectation of a universal knowledge, to raise questions and perplex ourselves and others with disputes about things to which our understandings are not suited, and of which we cannot frame in our minds any clear or distinct perception, or whereof (as it has perhaps too often happened) we have not any notions at all. If we can find out, how far the understanding can extend its view; how far it has faculties to attain certainty; and in what cases it can only judge and guess, we may learn to content ourselves with what is attainable by us in this state.' * * * 'This was that which gave the first rise to this Essay concerning the Understanding. For I thought that the first step towards satisfying several enquiries the mind of man is apt to run into was, to take a survey of our own understanding, examine our own powers, and see to what things they were adapted. Till that was done, I suspected we began at the wrong end, and in vain sought for satisfaction in a quiet and sure possession of truths that most concerned us whilst we let loose our thoughts into the vast ocean of being; as if all that boundless extent were the natural and undoubted possession of our understandings, wherein there was nothing exempt from its decisions, or that escaped its

comprehension. Thus men, extending their enquiries beyond their capacities, and letting their thoughts wander into those depths where they can find no sure footing, it is no wonder that they raise questions, and multiply disputes, which, never coming to any clear resolution, are proper only to continue and increase their doubts, and to confirm them at last in perfect scepticism. Whereas, were the capacities of our understanding well considered, the extent of our knowledge once discovered, and the horizon found, which sets the bounds between the enlightened and dark parts of things, between what is and what is not comprehensible by us; men would perhaps, with less scruple, acquiesce in the avowed ignorance of the one, and employ their thoughts and discourse with more advantage and satisfaction in the other.' Book I. c. i.

All this had been better expressed before, that is, with less verbosity and more precision; but the manner in which it is dwelt upon as well as many repetitions of the same thought, in different parts of the work, shows that it was not a casual, but a fixed sentiment of the author; yet how frequently does he lose sight of it! Indeed we can hardly persuade ourselves sometimes that he was aware of what he had stated in the above paragraph, or that he could have deliberately annexed what seems to be the obvious meaning to his words.

2. Another and a chief cause of the confusion which pervades the Essay concerning Human Understanding was the author's unskilfulnes in words, or the want of mastery in language considered as the instrument and medium of thought. He is a remarkable contrast to Hobbes and even to Bacon in this respect. Indeed their admonitions and example, as to the importance of attending to the nature of language and the meaning of words, in reference to the correct reception and communication of knowledge, seem to have been wholly lost upon him. He says, Book III. c. ix, 'I must confess, then, that when I first began this discourse of the understanding, and a good while after, I had not the least thought that any consideration of words was at all necessary to it. But when, having passed over the original and composition of our ideas, I began to examine the extent and certainty of our knowledge, I found it had so near a connexion with words that, unless their force and manner of signification were first well observed, there could be very little said clearly and pertinently concerning knowledge, which, being conversant about truth, had constantly to do with propositions. And, though it terminated in things, yet it was for the most part so much by the intervention of words that they seemed scarcely separable from our general knowledge. At least they interpose themselves so much, between our understanding and the truth which it would contemplate and apprehend, that like the medium through which visible objects pass, their obscurity and disorder does not seldom cast a mist before our eyes, and impose on our understandings. If we consider, in the fallacies men put upon themselves as well as others, and the mistakes in men's disputes and notions, how great a part is owing to words, and their uncertain or mistaken significations, we shall have reason to think this no small obstacle in the way to knowledge; which, I conclude, we are the more carefully to be warned of, because it has been so far from being taken notice of, as an inconvenience, that the arts of improving it have been made the business of men's study, and obtained the reputation of learning and subtilty, as we shall see in the following chapter. But I am apt to imagine that, were the imperfections of language, as the instrument of knowledge, more thoroughly weighed, a great many of the controversies, that make such a noise in the world, would of themselves cease; and the way to knowledge, and perhaps peace too, lie a great deal opener than it does.'

This is the burden (for the author always seems toiling at his task—there is never that appearance of ease and mastery inseparable from original genius, as in Bacon and Hobbes, and other powerful writers) of the third book, by far the best of the whole work, as justly observed by Mr. Stewart; who remarks, with equal justice, that it was an after-thought. If, indeed, it had been a forethought, many other parts of the essay would never have been written, and all the parts of it would have been written in a very different manner. It is much better written than any of the other books; but even from this (the composition is so indifferent) it is scarcely possible to extract a perfect sentence—we mean not rhetorically but logically considered: as to extracting a good paragraph it is out of the question.

'In one of Locke's most noted remarks concerning the varieties of genius, or rather the difference between wit and judgment,' says Mr. Stewart, 'he has been anticipated by Malebranche, on whose clear yet concise statement he does not seem to have thrown much new light by his very diffuse and wordy commentary.' This remark concerning diffuseness and wordiness, as we observed of that about fanciful hypotheses by Warburton, is not the less true and forcible for coming from Mr. Stewart. Diffuseness and wordiness, or say wordiness and indistinctness, which are almost identical, are the besetting sin of all Locke's compositions. He is constantly laboring at it and about it, but seldom succeeds in expressing the truth, the whole truth, and nothing but the truth. The third book of the essay, by far the best of the whole in every view, as already remarked, is little more than a 'very diffuse and wordy commentary' on a few sentences of Bacon and a few paragraphs of Hobbes; the last of whom in particular expresses with such clearness and force the principle so much dilated and encumbered by Locke, and lays so much reiterated emphasis upon it, as to render it almost unaccountable that the author of the Essay concerning the Human Understanding should have been so long before he was aware of its importance, and that he should have turned it to so little account.

The noted remark referred to by Mr. Stewart, as a very diffuse and wordy commentary on a clear and concise statement of Malebranche, is in reality a deterioration of a statement given by Hobbes; though expressed by the commentator with a clearness, and brevity, and precision, which he very seldom equals. We will give the

quotations in order from Locke, Malebranche, and Bacon, subjoining the statement of Hobbes which Mr. Stewart either did not know of or would not bring into the comparison before his readers.

'If in having our ideas in the memory ready at hand,' says Mr. Locke (Book II. c. xi.) 'consists quickness of parts; in this of having them unconfused, and being able nicely to distinguish one from another, when there is but the least difference, consists, in a great measure, the exactness of judgment and clearness of reason which is to be observed in one man above another. And hence, perhaps, may be given some reason of that common observation, that men who have a great deal of wit, and prompt memories, have not always the clearest judgment or deepest reason. For wit, lies most in the assemblage of ideas, and putting those together with quickness and variety wherein can be found any resemblance or congruity, to make up pleasant pictures and agreeable visions in the fancy; judgment on the contrary lies quite on the other side, in separating carefully, one from another, ideas wherein can be found the least difference, thereby to avoid being misled by similitude, and by affinity to take one thing for another.'

Let us now hear the epigrammatic Frenchman, who sacrifices nearly as much to conciseness as the prosing Englishman loses by diffusion.

'Il y a donc des esprits de deux sortes. Les uns remarquent aisément les différences des choses, et ce sont les bons esprits. Les autres imaginent et supposent de la ressemblance entr' elles, et ce sont les esprits superficiels.' Rech. de la Vérité. Liv. ii. Seconde Partie, chap. ix. There are two sorts of minds. The one remark easily the differences of things, and these are the good minds [or understandings]. The other imagine and conjecture their resemblance, and these are the superficial minds.

Let us now listen to one who spoke as few others have spoken.

'Maximum et velut radicale discrimen ingeniorum, quoad philosophiam et scientias, illud est; quod alia ingenia sint fortiora et aptiora ad notandas rerum differentias; alia, ad notandas rerum similitudines. Ingenia enim constantia et acuta, figere contemplationes, et morari, et hærere in omni subtilitate differentiarum possunt. Ingenia autem sublimia, et discursiva, etiam tenuissimas et catholicas rerum similitudines, et cognoscunt et componunt. Utrumque autem ingenium facilè labitur in excessum, prensando aut gradus rerum, aut umbras.'

'That strain I heard was of higher mood!' exclaims Mr. Stewart, with an enthusiastic delight in which we fully participate. It is the original strain which has been much sung and variously altered, often deteriorated, never improved. We are afraid of marring it, else we would do it into English for the sake of the common reader. But let us hear it from the philosopher of Malmsbury. 'Natural wit consists principally in two things; celerity of imagining (that is swift succession of one thought to another), and steady direction to some approved end. On the contrary, a slow imagination makes the defect or fault of the mind which is commonly called dulness, stupidity, and sometimes by other names, that signify slowness of motion, or difficulty to be moved.

'This difference of quickness is caused by the difference of men's passions, who love and dislike, some one thing, some another; and therefore some men's thoughts run one way, some another, and are held to, and observe differently, the things that pass through their imagination. And as in this succession of men's thoughts there is nothing to observe in the things they think on, but either in what they are like one another, or in what they are unlike, or what they serve for, or how they serve to such a purpose; those that observe their similitudes, in case they be such as are but rarely observed by others, are said to have a good wit; by which is meant, in this connexion, a good fancy. But they that observe their differences, and dissimilitudes (which is called distinguishing, discerning, and judging), if such discerning be not easy, are said to have a good judgment. * * * The former, that is, fancy, without the help of judgment, is not commended as an excellence; but the latter, which is judgment, is commended by itself, without the help of fancy. Besides the discretion, or distinguishing, of times, places, and persons, necessary to a good fancy, there is required also a frequent application of his thoughts to their end; that is to say, to some use to be made of them. This done, he that has this excellence, will be easily fitted with similitudes, that will please not only by illustration of discourse, and adorning it with new and apt metaphors, but also by the rarity of their invention. But, without steadiness and direction to some end, a great fancy is one kind of madness; such as they have that, entering into any discourse, are snatched from their purpose by every thing that comes in thought, into so many, and so long digressions and parentheses, that they utterly lose themselves.' *Leviathan*, part I. chap. viii.

This, too, is not a bad strain, and more worthy of ranking with that of Bacon than either the epigram of Malebranche, or 'the very diffuse and wordy commentary upon it' by Locke. But what we intended chiefly was to bring into comparison, or rather contrast, the mode of expressing thought, as presented in the writings of Locke, and the writings of those from whom he borrowed; and to show how deficient he is in the use of words, or language, as the instrument or medium of knowledge. There is hardly a noted remark in the whole Essay on the Human Understanding which may not be compared or contrasted with some passage or other of some preceding author, particularly Hobbes, from whom he borrowed more than from all other authors put together, though he hardly ever mentions the name of his benefactor except in a way of reproach. This was, perhaps, more from fear than from ingratitude, or from the desire of appropriating to himself the fame of others. In his reply to the bishop of Worcester he says, 'I am not so well read in Hobbes and Spinoza as to be able to say what were their opinions in this matter; but possibly there may be those who will think your lordship's authority of more use than justly decried names.'

3. A third cause of the defects of the Essay of Mr. Locke has been already indicated, a want of originality, that is, want of intellectual adaptation to his undertaking. There is a manifest lack of unity of design, and much inconsistency among the parts, because they were taken from very different minds; and because, when taken from one and the same mind, as for example from that of Hobbes, the commentator either did not under stand his materials fully, or wished to work them up anew in a manner, and for a purpose, to which they were not suited; or to incorporate them with others wholly incongruous and heterogeneous. Take, for example, what he says about truth, at the opening of the fifth chapter of the fourth book. He adopts the statement of Hobbes, 'that truth properly belongs only to propositions;' but he instantly makes nonsense of it by adding, 'whereof there are two sorts, viz. mental and verbal; as there are two sorts of signs commonly made use of, viz. ideas and words.' What the author could intend to mean by ideas being commonly made use of as signs, it is impossible for us to conjecture. From such a hopeful beginning we have this edifying sequel.—'To form a clear notion of truth it is very necessary to consider truth of thought and truth of words distinctly one from another; but yet it is very difficult to treat of them asunder. Because it is unavoidable, in treating of mental propositions, to make use of words; and then the instances given of mental propositions cease immediately to be barely mental, and become verbal. For a mental proposition, being nothing but a bare consideration of the ideas as they are in our minds, stripped of names, they lose the nature of purely mental propositions as soon as they are put into words. And that which makes it yet harder to treat of mental and verbal propositions separately, is, that most men, if not all, in their thinkings and reasonings within themselves, make use of words instead of ideas; at least when the subject of their meditation contains in it complex ideas.'

Truly the case is not only hard, but desperate. What light or conduct of the understanding any man can find in statements like these we cannot divine; yet they are a fair specimen of very many of the statements contained in Mr. Locke's celebrated work. Such indistinctness, such confusion, or rather such absence of conceivable meaning, cannot possibly exist where a man has distinct thoughts in his mind, and writes only from his own understanding.

We might have remarked, under the former head, that it is not merely in putting words together that the author fails, which failure is generally connected with mental confusion, but in regard to single terms as signs of ideas, to use his own expression, he is almost habitually faulty. Take, for instance, his noted word idea, which is here, and there, and every where, throughout the essay. What can be more indefinite than this verbal Proteus? It seems to mean any thing, every thing, and nothing, by turns. And this, though a notable, is not a solitary example. There is hardly a word of much importance, and frequent recurrence, which is not applied in the same loose and careless manner. This of itself is a striking proof of want of adaptation, or qualification, for metaphysical research and discussion. There was nothing, Hobbes said (in a passage already quoted), that he distrusted so much as his diction or expression; but, notwithstanding all Mr. Locke's sage remarks and remonstrances on the subject, there seems to have been nothing that he so little distrusted.

What then, it may be said, are the merits of Mr. Locke?—We are fully disposed to allow them to be great, though not precisely such as have been generally assigned. He was a sincere lover of truth, and a most determined enemy to error and scholastic pretension and imposition. His work, though not remarkable for originality, consistency, or any thing like a luminous and instructive exposition of the subjects on which it professedly treats, contains many judicious remarks, brought together from various quarters; and, though it might have been so written as to do much more, it has certainly done much in clearing away the rubbish of a false and deceitful philosophy, or rather of learned jargon. The third book, though very diffuse and wordy, is still calculated to be highly useful to young enquirers: and it is impossible almost to estimate the good which the first book (unquestionably the ablest) has effected in banishing the Platonic mysticism and absurdity of innate ideas; which, so late as the times of Descartes, Leibnitz, Cudworth, and even Price, maintained a hold of minds much above intellectual mediocrity. It is true, some harm may have been done by the same book, in leading such as Condillac, Hartley, and many others, to assign too much to the senses and too little to the mind itself; yet we think it does not merit the treatment it has received from Reid, Stewart, and others of the same school.

The last-named author is sometimes rather indignant at what he calls the sophistry, and represents as of dangerous tendency, in the first book of the Essay: at other times he is not only extremely candid, but even eulogial towards the work as a whole. 'The enquiries,' he remarks in the first and second books, 'which are of a much more abstract, as well as scholastic, nature, than the sequel of the work, probably opened gradually on the author's mind in proportion as he studied his subject with a closer and more continued attention. They relate chiefly to the origin and to the technical classification of our ideas frequently branching out into collateral, and sometimes into digressive, discussions, without much regard to method or connexion. The third book (by far the most important of the whole), where the nature, the use, and the abuse of language, are so clearly and happily illustrated, seems, from Locke's own account, to have been a sort of after-thought; and the two excellent chapters on the association of ideas, and on enthusiasm (the former of which has contributed as much as any thing else in Locke's writings, to the subsequent progress of metaphysical philosophy) were printed, for the first time, in the fourth edition of the Essay.'

Respecting what Locke named, not very happily, association of ideas, such as are more just and generous to the memory of Hobbes than Mr. Stewart, admit that he was the first, at least in mo-

dern times, to state the mental fact or principle so much philosophised upon since his time (to what important purpose we hardly know notwithstanding Mr. Stewart's high-sounding language about the progress of metaphysical philosophy), and that he stated it in a far more striking and philosophical manner than his commentator.

The following is language far more loftily panegyrical both towards Mr. Locke and metaphysics than the writer of this article could sincerely adopt. 'But,' says Mr. Stewart, 'although these considerations render the two first books inferior in point of general utility to the two last, they do not materially detract from their merit, as a precious accession to the theory of the human mind. On the contrary, I do not hesitate to consider them as the richest contribution, of well-observed and well-described facts, which was ever bequeathed to this branch of science by a single individual; and as the indisputable (though not always acknowledged) source of some of the most refined conclusions, with respect to the intellectual phenomena which have been since brought to light by succeeding inquirers.'

The following perhaps may be regarded as a beautiful specimen of what we have failed in towards Mr. Locke:—

'After the details given by Locke himself, of the circumstances in which his Essay was begun and completed, more especially after what he has stated of 'the discontinued way of writing,' imposed on him by the avocations of a busy and unsettled life, it cannot be thought surprising, that so very little of method should appear in the disposition of his materials; or that the opinions which, on different occasions, he has pronounced on the same subject should not always seem perfectly steady and consistent. In these last cases, however, I am inclined to think that the inconsistencies, if duly reflected on, would be found rather apparent than real. It is but seldom that a writer, possessed of the powerful and upright mind of Locke, can reasonably be suspected of stating propositions in direct contradiction to each other. The presumption is, that, in each of these propositions, there is a mixture of truth, and that the error lies chiefly in the unqualified manner in which the truth is stated; proper allowances not being made, during the fervour of composition, for the partial survey taken of the objects from a particular point of view. Perhaps it would not be going too far to assert, that most of the seeming contradictions which occur in authors animated with a severe love of truth, might be fairly accounted for by the different aspects which the same objects presented to them upon different occasions. In reading such authors accordingly, when we meet with discordant expressions, instead of indulging ourselves in the captiousness of verbal criticism, it would better become us carefully and candidly to collate the questionable passages; and to study so to reconcile them, by judicious modifications and corrections, as to render the oversights and mistakes of our illustrious guides subservient to the precision and soundness of our own conclusions. In the case of Locke it must be owned, that this is not always an easy task, as the limitations of some of his most exceptionable propositions are to be collected, not from the context, but from different and widely separated parts of his essay.'

We leave our readers to judge of the soundness of the above criticism; but we thought it curious and worthy of insertion as a kind of contrast to our own; and we wished that Locke might have some chance of fair play with us.

In speaking of the celebrity which the Essay on the Understanding so soon acquired, the same writer adds very justly, 'something I suspect must be ascribed to the political importance which Mr. Locke had previously acquired as the champion of religious toleration, as the great apostle of the revolution, and as the intrepid opposer of a tyranny which had recently been overthrown.' No doubt all this did much for the work; and a high reputation once obtained is sure to remain unless put down by some powerful re-action of opinion. Another circumstance was the magnitude of the work; it seemed a complete body of metaphysics. A third favorable circumstance was the modesty and amicableness of the author; in this respect he was a complete contrast to his metaphysical master. But it is probable that the celebrity of the essay is owing chiefly to its indefinite character. It has been justly observed that 'most readers delight to repose in generalities.' The author so often quoted already, when speaking of Leibnitz, remarks with more than usual acuteness, 'the phraseology is so indeterminate, that it may be interpreted in various senses essentially different from each other. Whether this vagueness of language was the effect of artifice, or of real vagueness in the author's notions, may perhaps be doubted; but that it has contributed greatly to extend his reputation, among a very numerous class of readers, may be confidently asserted.'

As almost all sects, and parties, and persons in Britain have vied with one another in lauding Locke; so his fame has been great on the continent, particularly in France. According to Voltaire he is the Hercules of metaphysics, who has fixed the boundaries of the human understanding. Locke est l'Hercule de la metaphysique, qui a posé les bornes de l'esprit humain. This is sublime, but another passage of the same celebrated Voltaire is quite the marvellous. 'Locke alone has developed the human understanding in a work where there is nothing but truths, and what renders the work perfect all its truths are luminous. Locke seul a developpé l'entendement humain dans un livre où il n'y a que des vérites; et ce qui rend l'ouvrage parfait, toutes ces vérités sont claires.' Is there here any evidence that this smart Frenchman ever read the perfect work concerning the human understanding? Or need we wonder at the unmeasured praise of Locke after this?

Condillac is to be regarded as the French interpreter and commentator of Locke; and it is universally allowed that he has performed his task with great perspicuity and eloquence. But he has not given the whole of Locke and nothing but Locke; for he has so much transmuted the English doctrines about the human understanding, that it would be more proper to call them after Gassendi; and some French writers are now

inclined to restore the long alienated fame of the true philosophy of the human mind to its rightful owner; as has already appeared by a quotation from Degerando. According to Condillac all our ideas, thoughts, mental operations, and emotions, are nothing but transformed sensations. What he means by transformation he has not defined. 'If we consider,' says he, 'that to remember, to compare, to judge, to distinguish, to imagine, be astonished, to have abstract ideas, to have ideas of number and duration, to know truths, whether general or particular, are but so many modes of being attentive; that to have passions, to love, to hate, to hope, to fear, to will, are but so many different modes of desire; and that attention in the one case, and desire in the other case, of which all these feelings are modes, are themselves, in their origin, nothing more than modes of sensation, we cannot but conclude that sensation involves in it all the faculties of the soul.'—*Traité des Sensations*, part I. chap. vii.

This is a very short and simple process no doubt. The soul and all its faculties are resolvable into the five senses, and there is an end of the matter. Locke allowed that there was something of a mind or soul to begin, with analogous to a sheet of white paper, and Hobbes thought it rather analogous to a slate. But according to Condillac there is nothing whatever beside or beyond, or distinct from the senses, or their agency, called sensation; all that is supposed to be distinct from this is nothing but itself transformed like a harlequin into another character when performing a different part. Whatever we may think of this doctrine, says Dr. Brown, Lecture 33, as true or false, ingenious or absurd, it seems, at least, scarcely possible that we should regard it as the doctrine of Locke —of him who sets out with a primary division of our ideas, into two distinct classes, one class of which alone belongs to sensation; and who considers even this class of our mere ideas, not as involving all the operations of the mind with respect to them, but only as the objects of the mind in these various operations, as being what we compare, not the very feelings of our comparison itself, the inducements to passion, not what constitutes any of our passions, as a state, or series of states of the mind. To render the paragraph quoted from Condillac at all accordant with the real doctrine of Locke, it would be necessary to reverse it in almost every proposition which it involves.

We will not detain the reader longer with Condillac, who may be regarded, however, as standing at the head of the metaphysicians on the continent who consider themselves the disciples of the metaphysical Hercules of England. According to both Mr. Stewart and Dr. Brown they have all misunderstood their master's doctrine; whether this proves their dulness or perversity, or his unfathomable profundity, or dazzling brightness, the reader must judge for himself.

HARTLEY.

Dr. Hartley is known, and was for a time, to some extent at least, admired as the author of a work entitled Observations on Man; in which he propounded a very fanciful theory of vibration for the purpose of explaining the operations of the mind. Dr. Brown has expended some very unnecessary refutation on the vibrating theory in one of his lectures; especially as he states that it 'has now fallen into merited disrepute even with those who are inclined, in other respects, to hold in very high estimation the merits of Hartley as an intellectual analyst.' 'His followers, he continues, have generally been extravagant admirers of his philosophical genius, which I own seems to me to be very opposite to the genius of sound philosophy. That there is considerable acuteness, however, displayed in his work, and that it contains some successful analyses of complex feelings, I am far from denying; and, as intellectual science consists so much in the analysis of the complex phenomena of thought, its influence in this respect has unquestionably been of service, in promoting that spirit of free enquiry, which, in a science that presents no attraction to the senses, is so easily laid asleep, or at least so readily acquiesces, as if to justify its indolence, in the authority of great names, and of all that is ancient in error and venerable in absurdity. But though the influence of his philosophy may have been of service in this respect, the advantage which has perhaps flowed from it in this way must have been inconsiderable compared with the great evil which has unquestionably flowed from it in another way, by leading the enquirer to acquiesce in remote analogies, and to adopt explanations and arrangements of the phenomena of mind, not as they agree with the actual phenomena, but as they chance to agree with some supposed phenomena of our material part.'

Dr. Hartley has given the same general account of the origin of ideas with Condillac; but so far from claiming the sanction of Locke's authority he points out the difference between his own opinion and that expressed by the author of the Essay on the Understanding. 'It may not be amiss (he remarks in the introduction to his work) here to take notice how far the theory of these papers has led me to differ in respect of logic from Mr. Locke's excellent Essay on the Human Understanding, to which the world is so much indebted for removing prejudices and incumbrances, and advancing real and useful knowledge. First, then, it appears to me, that all the most complex ideas arise from sensation, and that reflection is not a distinct source, as Mr. Locke makes it.'

The materialists and necessitarians have a sort of natural affection for Hartley; and Dr. Priestley speaks in very admiring strains of the author of the vibratory and vibratiuncle theory. 'Something was done,' (he says, remarks on Reid, Beattie and Oswald), 'in this field of knowledge by Descartes, very much by Mr. Locke, but most of all by Dr. Hartley, who has thrown more useful light on the theory of mind, than Newton did upon the theory of the natural world.' What with one light and another that has been thrown upon the theory of mind, the northern lights both Scottish and German, and the effulgent radiance of Locke, Condillac, and Hartley, we might have expected of course to be dark, as we are, through excess of brightness.

According to Mr. Stewart the theory of Hartley seems to be fast passing into oblivion: 'the temporary popularity which it enjoyed in this country having in a great measure ceased with the life of its zealous and indefatigable apostle Dr. Priestley.' Yet one of his co-operators in the Supplement to the Encyclopædia Britannica, the writer of the article Education, is almost as ardent an admirer of Hartley as Priestley himself. 'It is surprising,' he says, 'how little the author of the vibratory theory has left unaccomplished.' It is truly astonishing too, what Condillac, Helvetius, and Cabanis have done; as to Locke, of course, the Hercules of metaphysics, none but Voltaire is fit to tell his metaphysical exploits.

HUME.

Mr. Hume commenced his literary career in the twenty-fifth year of his age, by writing a work entitled a Treatise of Human Nature, suggested no doubt by that of Hobbes, bearing essentially the same title. The reception of this first work was sufficient to have extinguished the ambition of authorship in a less ardent mind. 'Never literary attempt was more unfortunate,' says the author; 'it fell dead-born from the press without reaching such distinction as even to excite a murmur among the zealots.' He afterwards endeavoured to adapt the contents of the abortive publication to the public taste by modifying them anew and presenting them in the popular and fashionable form of essays. According to Mr. Stewart, with whom every thing save and except pure Hobbism, is metaphysical optimism, the Treatise of Human Nature 'has contributed, either directly or indirectly, more than any other single work, to the subsequent progress of the Philosophy of the Human Mind.' What with the sure law of continuity and infinite progression, the Philosophy of the Human Mind will doubtless at last reach infinitesimal perfection in the arrangement of well authenticated facts, refined speculations, and all the genera and species of intellectual phenomena.

The objects contemplated in the Treatise of Human Nature are thus presented by the author: ''Tis evident that all the sciences have a relation, greater or less, to human nature, and that, however wide any of them may seem to run from it, they still return back by one passage or another. Even mathematics, natural philosophy, and natural religion, are in some measure dependent on the science of man, since they lie under the cognizance of men, and are judged of by their powers and faculties. * * * If, therefore, the science of mathematics, natural philosophy, and natural religion, have such a dependence on the knowledge of man, what may be expected in the other sciences, whose connexion with human nature is more close and intimate? The sole end of logic is to explain the principles and operations of our reasoning faculty, and the nature of our ideas: morals and criticism regard our tastes and sentiments, and politics consider men as united in society and dependent on each other. * * * Here, then, is the only expedient from which we can hope for success in our philosophical researches, to leave the tedious lingering method which we have hitherto followed, and, instead of taking now and then a castle or village on the frontier, to march up directly to the capital or centre of these sciences, to human nature itself; which being once masters of we may every where else hope for an easy victory. From this station we may extend our conquests over all those sciences which more intimately concern human life, and afterwards proceed at leisure to discover more fully those which are the objects of pure curiosity. There is no question of importance whose decision is not comprised in the science of man; and there is none which can be decided with any certainty before we become acquainted with that science. In pretending, therefore, to explain the principles of human nature, we in effect propose a complete system of the sciences, built on a foundation almost entirely new, and the only one upon which they can stand with security.'

See, the conquering hero come! A precocious Kant! A second Hercules of metaphysics, mightier far than the first! But let us hear this wonderful projector, so pregnant with metaphysical wisdom, disburthen himself of his philosophical inspiration.

'And, as the science of man is the only solid foundation for the other sciences, so the only solid foundation we can give to this science itself must be laid on experience and observation. 'Tis no astonishing reflection to consider, that the application of experimental philosophy to moral subjects should come after that to natural, at the distance of above a whole century; since we find, in fact, that there was about the same interval betwixt the origin of the sciences; and that, reckoning from Thales to Socrates, the space of time is nearly equal to that betwixt my lord Bacon and some late philosophers in England, who have begun to put the science of man on a new footing, and have engaged the attention and excited the curiosity of the public.'

This is all very lofty and very wonderful, and no doubt mortified the pride of the author to the last hour of his life. Hence he was always peevish and querulous on the subject of this juvenile work as he terms it. 'Several writers,' he says, 'who have honored the author's philosophy with answers, have taken care to direct all their batteries against that juvenile work, which the author never acknowledged, and have affected to triumph in any advantage which they imagined they had gained over it: a practice very contrary to all rules of candor and fair dealing, and a strong instance of those polemical artifices which bigoted zeal thinks itself authorised to employ. Henceforth the author desires that the following pieces may alone be regarded as containing his philosophical sentiments and principles.' 'I was carried away, by the heat of youth and invention, to publish too precipitately. So vast an undertaking, planned before I was one-and-twenty, and composed before twenty-five, must necessarily be very defective.—I have repented my haste a hundred and a hundred times.'

The youthful projector or aspiring adventurer in the wonder-working science of man, not succeeding in his ambitious expectations in marching up to the capital,—in extending his conquests,—in acquiring an easy victory,—in

pretending to explain the principles of human nature, and proposing a complete system of the sciences, built on a foundation almost entirely new, and the only one on which they can stand with security, became desperate. Retaining, like Lucifer after his fall, however, an insatiable ambition of renown, and having a rooted antipathy to religion, he thought he might be a Hercules of scepticism, and destroy all such superstitious monsters as the vulgar principles of human belief. Accordingly, in turning sceptic, and champion of scepticism, he turned sophist also; for the one never yet existed, in any thing like perfection, without the other. Notwithstanding all Mr. Stewart's tenderness, or rather favoritism, towards Mr. Hume (not very intelligible but on the supposition of nationality), the author of the first treatise of human nature is in every respect honorable, and, hated as he is, lovely when compared with the author of the second. The first cannot, in any fairness or justice, be pronounced a sophist.

The following statement by Mr. Stewart is upon the whole just, and it is sufficiently candid or rather partial, towards Hume:—'The fundamental principles from which Mr. Hume sets out differ more in words than in substance [he was ambitious of standing alone and seeming to differ even from those with whom he essentially agreed,—if indeed he agreed with any one fixed principle] from those of his immediate predecessors. According to him, all the objects of our knowledge are divided into two classes, impressions and ideas: the former, comprehending our sensations, properly so called, and also our perceptions of sensible qualities [two things betwixt which Mr. Hume's system does not lead him to make any distinction]; the latter, the objects of our thoughts when we remember or imagine, or in general exercise any of our intellectual powers on things which are past, absent, or future. These ideas he considers as copies of our impressions, and the words which denote them as the only signs entitled to the attention; every word professing to denote an idea, of which the corresponding impression cannot be pointed out, being ipso facto unmeaning and illusory. The obvious result of these principles is that, what Mr. Hume calls impressions, furnish, either immediately or mediately, the whole materials about which our thoughts can be employed; a conclusion coinciding exactly with the account of the origin of our ideas borrowed by Gassendi from the ancient Epicureans. With this fundamental principle of the Gassendists Mr. Hume combined the logical method recommended by their great antagonists the Cartesians; and, what seems still more remote from his Epicurean starting-ground, a strong leaning to the idealism of Malebranche and of Berkeley. Like Descartes, he began with doubting of every thing, but he was too quick-sighted to be satisfied, like Descartes, with the solutions given by that philosopher of his doubts. On the contrary, he exposes the futility, not only of the solutions proposed by Descartes himself, but of those suggested by Locke and others among his successors; ending at last where Descartes began, in considering no one proposition as more certain, or even as more probable, than another. That the proofs alleged by Descartes, of the existence of the material world, are quite inconclusive, had been already remarked by many. Nay it had been shown, by Berkeley and others, that, if the principles be admitted on which Descartes, in common with all philosophers, from Aristotle downwards, proceeded, the existence of the material world is impossible. A few bold thinkers, distinguished by the name of Egotists, had gone still farther than this, and had pushed their scepticism to such a length as to doubt of every thing but their own existence. According to these the proposition cogito ergo sum is the only truth which can be regarded as absolutely certain. It was reserved for Mr. Hume to call in question even this proposition, and to admit only the existence of impressions and ideas. To dispute against the existence of these he conceived to be impossible, inasmuch as they are the immediate subjects of consciousness. But, to admit the existence of the thinking and percipient I, was to admit the existence of that imaginary substance called mind, which, according to him, is no more an object of human knowledge than the imaginary and exploded substance called matter.

'From what has already been said it may be seen, that we are not to look in Mr. Hume's treatise for any regular or connected system. It is neither a scheme of materialism nor a scheme of spiritualism; for his reasonings strike equally at the root of both these theories. His aim is to establish a universal scepticism, and to produce in the reader a complete distrust of his own faculties. For this purpose he avails himself of the data assumed by the most opposite sects, shifting his ground skilfully from one position to another, as best suits the scope of his present argument. With the single exception of Bayle he has carried this sceptical mode of reasoning farther than any other modern philosopher. Cicero, who himself belonged nominally to the same school, seems to have thought, that the controversial habits imposed on the academical sect, by their profession of universal doubt, required a greater versatility of talent and fertility of invention than were necessary for defending any particular system of tenets; and it is not improbable that Mr. Hume, in the pride of youthful genius, was misled by this specious but very fallacious idea. On the other hand, Bayle has the candor to acknowledge that nothing is so easy as to dispute after the manner of the sceptics; and to this proposition every man of reflection will find himself more and more disposed to assent as he advances in life. It is experience alone that can convince us how much more difficult it is to make any real progress in the search after truth, than to acquire a talent for plausible disputation.

'That this spirit of sceptical argument has been carried to a most pernicious excess in modern Europe, as well as among the ancient academics, will be now very general allowed; but, in the form in which it appears in Mr. Hume's Treatise, its mischievous tendency has been more than compensated by the importance of those results for which it has prepared the way. The principles which he assumes were sanctioned in common by Gassendi, by Descartes, and by

Locke; and from these, in most instances, he reasons with great logical accuracy and force. The conclusions to which he is thus led are often so extravagant and dangerous, that he ought to have regarded them as a proof of the unsoundness of his data; but, if he had not the merit of drawing this inference himself, he at least forced it so irresistibly on the observation of his successors as to be entitled to share with them in the honor of their discoveries. Perhaps, indeed, it may be questioned if the errors which he adopted from his predecessors would not have kept their ground till this day had not his sagacity displayed so clearly the consequences which they necessarily involve. It is in this sense that we must understand a compliment paid by the ablest of his adversaries, when he says, that Mr. Hume's premises often do more than atone for his conclusions.'

'The bias of Mr. Hume's mind to scepticism seems to have been much encouraged, and the success of his sceptical theories in the same proportion promoted, by the recent attempts of Descartes and his followers to demonstrate self-evident truths—attempts which Mr. Hume clearly perceived to involve, in every instance, that sort of paralogism which logicians call reasoning in a circle. The weakness of these pretended demonstrations is triumphantly exposed in the Treatise of Human Nature; and it is not very wonderful that the author, in the first enthusiasm of his victory over his immediate predecessors, should have fancied that the inconclusiveness of the proofs argued some unsoundness in the propositions which they were employed to support. It would, indeed, have done still greater honor to his sagacity if he had ascribed this to its true cause, the impossibility of confirming, by a process of reasoning, the fundamental laws of human belief. From that strong sceptical bias which led this most acute reasoner, on many important questions, to shift his controversial ground according to the humor of the moment, one favorable consequence has resulted, that we are indebted to him for the most powerful antidotes we possess against some of the most poisonous errors of modern philosophy.'

That Mr. Hume was an acute reasoner or rather arguer, and that he has done some good which he never intended, we willingly admit; but take it altogether we hardly know of an intellectual character for which we feel less respect than for his.

REID, OSWALD, BEATTIE, AND STEWART.

We class these names together because they are identified with what is termed the Scotch metaphysics; but we mean to take no other notice of Oswald and Beattie. Even Mr. Stewart is almost ashamed to own them, with all their boasted common sense. The following dexterous turn, when it seemed impossible to avoid saying something of their merits, is amusing: 'Of the other works by Scottish metaphysicians, which appeared soon after the enquiry into the Human Mind, I have not left myself room to speak; I know of none of them from which something important may not be learned; while several of them (particularly those of Dr. Campbell) have struck out many new and interesting views. To one encomium all of them are well entitled, that of aiming steadily at the advancement of useful knowledge and of human happiness. But the principles on which they have proceeded have so close an affinity to those of Dr. Reid, that I could not, without repeating over what I have already said, enter into any explanation concerning their characteristical doctrines.'

We wish indeed that, with all their good intentions, their manner of opposing scepticism (and the remark applies also to Dr. Reid and Mr. Stewart) had been more calculated to do good and less such as to do harm. We can speak feelingly on the subject when we say that the remark applied by Mr. Stewart to the scheme of optimism is but too applicable to the scheme of common sense as treated of by Oswald, Beattie, —we will not name any more. 'The success of his attempt (Voltaire's) was much aided by the confused and inaccurate manner in which the scheme of optimism had been recently stated by various writers, who in their zeal to vindicate the ways of God to men, had been led to hazard principles more dangerous in their consequences than the prejudices and errors it was their aim to correct.'

But it is with Dr. Reid, and his disciple and commentator Mr. Stewart, as inductive philosophers of the human mind, that we have to do. Somewhat more than twenty years ago the former appeared to the writer of this paper a perfect Socrates, and the latter as perfect a Plato, delivering in divine eloquence the wisdom of his sage master 'the experimental father of the true theory of the human mind;' but time makes great changes. The venerable father of the Scottish metaphysics, may, between Mr. Stewart (who with all his partiality has detected in him not a few mistakes) and Dr. Brown, be compared to the old gentleman in the hands of his two wives who made him quite bald and bare, one objecting to the black and the other to the white hairs on his head. Mr. Stewart, indeed, is gentle and forbearing, for real affection is always unwilling to offend or to hurt; but Dr. Brown pulls up by the roots most unmercifully all Dr. Reid's claims to admiration or even respect as an inductive philosopher: he employs three or four long, logical, eloquent, lectures in proving that Dr. Reid's grand intellectual discovery or metaphysical achievement was, after all that had been said of its wonderful importance, both by himself and his disciples, nothing but an egregious blunder.

The following is the manner in which he opens his destructive battery upon the reputation of the Hercules of the Scottish metaphysics; who it was supposed had vanquished all the giants, and annihilated all the monsters of idealism. 'While by philosophers in one part of the island, Dr. Reid's merits seem to have been unjustly undervalued, I cannot but think also that, in his own country, there has been an equal, or rather a far greater tendency to over-rate them,—a tendency arising in part from the influence of his academic situation, and his amiable personal character, partly, and in a very high degree, from the general regard for the moral and religious objects

which he uniformly had in view, as contrasted with the consequences that were supposed to flow from some of the principles of the philosopher whose opinions he particularly combated; and partly also, I may add, from the eloquence of his illustrious pupil and friend and biographer, whose understanding, so little liable to be biassed by any prejudices but those of virtue and affectionate friendship, has yet, perhaps, been influenced in some degree by those happy and noble prejudices of the heart, and who, by the persuasive charms both of his lectures and of his writings, could not fail to cast, on any system of opinions which he might adopt and exhibit, some splendor of reflection from the brilliancy of his own mind.

'The genius of Dr. Reid does not appear to me to have been very inventive, nor to have possessed much of that refined and subtile acuteness, which, capable as it is of being abused, is yet absolutely necessary to the perfection of metaphysical analysis.

'It is chiefly on his opinions, in relation to the subject at present under our view, that his reputation as an original thinker rests. Indeed it is on these that he is inclined himself to rest it. In a part of a letter to Dr. Gregory, preserved in Mr. Stewart's Memoir, he considers his confutation of the ideal system of perception as involving almost every thing which is truly his. 'I think there is hardly any thing that can be called mine,' he says, 'in the philosophy of mind which does not follow with ease from the detection of this prejudice.' Yet there are few circumstances, connected with the fortune of modern philosophy, that appear to me more wonderful than that a mind like Dr. Reid's, so learned in the history of metaphysical science, and far too honorable to lay claim to praise to which he did not think himself fairly entitled, should have conceived that, on the point of which he speaks, any great merit, at least any merit of originality, was justly referrible to him particularly. Indeed, the only circumstance more wonderful is, that the claim thus made by him, should have been so readily and generally admitted.'

The claim had been long disallowed (notwithstanding all the strenuous and indefatigable efforts of the illustrious pupil), by competent judges beyond the Scottish boundaries; but it was a kind of revolution for it to be overthrown in the university of the Scottish capital, and in the very chair so long filled by Dr. Reid's disciple and commentator. No doubt, however, according to Mr. Stewart's metaphysical optimism, or sure and certain hope of the intellectual philosophy, this was, with Mr. Hume's daring scepticism, working forward the science of the human mind.

It is not necessary to detain the reader longer with the author of an Enquiry into the Human Mind, and Essays on the Intellectual and Active Powers of Man. His glory is departed we suspect from even the Scottish universities; whose future metaphysical professors will probably be as shy of owning him as Mr. Stewart is of embracing affectionately the intellectual memory of his compeers Oswald and Beattie. This sage, as Dr. Currie and Mr. Stewart were wont to designate him, now stands convicted of 'much zealous blundering' (to give Dr. Brown's words) in professing to confute what existed nowhere but as phantoms of his own confused brain.

Concerning 'his illustrious pupil' we would rather not speak our mind if we could well be silent, as we cannot sincerely characterise him as an inductive philosopher of the human mind in flattering terms, and should be unwilling to wound the feelings of an aged and excellent individual. But we think it very unfortunate for his intellectual reputation that his name is at all identified with the metaphysical history of the nineteenth century; for, as expressed by a contemporaneous critic, he has certainly 'mistaken his forte.' Few men perhaps who have been thrown by circumstances into abstract enquiries and abstruse speculations, have possessed less of metaphysical adaptation for them from either nature or art: and we fear that his secondary claims as an elegant scholar and accomplished literary man, which, standing alone, might have been well supported and have long endured, will fall with his primary pretensions. We will not discuss the merits of his intellectual faculties and powers (to use a sort of favorite expression of his own), or of his productions considered either in a mere literary or in a philosophical view; for, though not afraid to blame, we would rather praise. But there are two points on which we cannot forbear expressing our opinion. The one is what we consider the philosophic bigotry of Mr. Stewart, and the other is what we call his philosophic pretension.

We have availed ourselves very freely of his two dissertations in the supplement to the Encyclopædia Britannica, which display the extent and the diversity of his reading; and we feel grateful for the trouble they saved and the assistance they afforded us. At the same time we must observe that they contain a very great proportion not only of unsound, but of unfair criticism. If authors happen to hold opinions deemed by Mr. Stewart adverse to what he considers the true theory of mind or to natural religion (it would not be decorous perhaps to manifest a spark of zeal for revealed religion), whatever be their genius or intellectual rank, they would seem fit objects for unsparing hostility, we had almost said relentless persecution. He is tolerant and tender indeed towards Mr. Hume, as already noticed; but witness his unceasing hostility towards Gassendi and Hobbes, and all the Epicureans as he designates them; witness his conduct towards even Locke, notwithstanding all his courtly caution and complimentary courtesy, for he accuses him of sophistry; witness his remarks on such disciples of Locke as Law, Watson, and the ingenious Tucker, of whom he thus writes:—'Of an author whom Dr. Paley has honored with so very warm a eulogy, it would be equally absurd and presumptuous to dispute the merits. Nor have I any wish to detract from the praise here bestowed on him as an original thinker and observer. I readily admit, also, his talent for illustration, although it sometimes leads him to soar into bombast, and more frequently to sink into buffoonery. As an honest enquirer after moral and religious truth he is entitled to the most

unqualified approbation. But I must be permitted to add that, as a metaphysician, he seems to me much more fanciful than solid; and at the same time to be so rambling, verbose, and excursive (was it prudent to cast such epithets?) as to be more likely to unsettle than to fix the principles of his readers.'

This is a favorable specimen, compared to much that might be brought forward. Mr. Stewart's antipathy seems to be in proportion to the originality of an author, if that author happen to be beyond the pale of his own sect, or not included within the circle of metaphysical orthodoxy. The odium theologicum has long been proverbial; and we say it with a sigh, for we have felt what we express, that the odium metaphysicum of Oswald, Beattie, Reid, and Stewart, has done more serious mischief than all their shallow metaphysics and blundering reasonings. The writer of this will not yield to Mr. Stewart in religious belief, or in deep sense of the importance of religion and morality; and his regret is, that religious and moral principles should be wounded by their professed friends, or betrayed by their weak advocates.

The second charge which we have to prefer against Mr. Stewart is that of philosophic assumption and pretension. Indeed we cannot believe that he is aware of what we are now complaining of, to the extent to which it pervades his writings, but that it has silently grown up with him into an inveterate but offensive habit. Still the incessant recurrence of such high sounding, quackish looking, expressions, as intellectual data, intellectual phenomena, true theory of mind, inductive philosophy of the mind, experimental philosophy of the mind, the science of the mind, intellectual philosophy, &c. &c. &c., is perfectly annoying. If Mr. Stewart be not the profoundest metaphysician, the greatest intellectual discoverer, the acutest intellectual analyst, the most successful observer of mental phenomena that any age or country has produced, he will at least descend to posterity, and be the wonder of all succeeding times as the greatest inventor and improver of metaphysical grandiloquentia that the world ever saw. All that went before him was tame and timid and sheepishly modest, when compared to him. If Descartes the father of the experimental philosophy of the mind, or Malebranche who did so much for it as an inductive science, or such Epicureans as Gassendi, or old Hobbes, or Hercules himself, were to come back to these lower intellectual regions, they would stare with astonishment at our new nomenclature.

Hobbes entitled his celebrated Libellum (which Mr. Stewart thinks with Addison, and other great judges, the best of all his works), Human Nature; Malebranche called his work the Search of Truth; Locke, with a degree of modesty which incurred the charge of a misnomer, denominates his Herculean labor, an Essay concerning Human Understanding; Hume entitled his juvenile production (in which, as we have seen, there is something of the mock heroic about the science of man, whether sincere or insidious) a Treatise of Human Nature; that sage, or Socrates, of the common-sense metaphysics, Dr. Reid, was so unassuming as to be content with such humble titles as an Enquiry into the Human Mind, Essays on the Intellectual and Active Powers of Man. It was reserved for Mr. Dugald Stewart to have all the glory of being the first author and professor of the Philosophy of Mind; and of rendering intellectual science, intellectual phenomena, and many similar philosophic forms of speech concerning metaphysics, as familiar in our mouths as household words In this respect he thought himself no doubt a metaphysical benefactor; judging that (to quote his own words, first dissertation, p. 59), 'above all, whatever tends to embody, in popular forms of expression, the ideas and feelings of the wise and good, augments the natural powers of the human understanding, and enables the succeeding race to start from a higher ground than was occupied by their fathers.'

Doubtless so far as grandiloquence is embodied in popular speech, and concerned in augmenting the natural powers of the understanding, the succeeding race will start from high ground indeed; they will at least be so much mounted towards the etherial regions as to be fairly up among the clouds, on the alpine summits of lofty phraseology. But we are sick of the nauseous topic, and will quit it, we hope for ever, by quoting another passage from Mr. Stewart, which requires very little alteration to adapt it as completely to himself and his boasted science, and his metaphysical coadjutors, as if it had been 'made for them.' 'The fundamental principles of Puffendorff (first dissertation, p. 130) possess little merit in point of orginality, being a sort of medley of the doctrine of Grotius, with some opinions of Hobbes; but his book is entitled to the praise of comparative conciseness, order, and perspicuity; and accordingly came very generally to supplant the treatise of Grotius, as a manual or institute for students, notwithstanding its immense inferiority in genius, in learning, and in classical composition. The authors who in different parts of the continent have since employed themselves in commenting on Grotius and Puffendorff [substitute Locke and Reid, and understand for the authors or lecturers, Scottish professors], or in abridging their systems, or in altering their arrangements, are innumerable; but, notwithstanding all their industry and learning, it would be very difficult to name any class of writers whose labors have been of less utility to the world. The same ideas are constantly recurring in an eternal circle; the opinions of Grotius and of Puffendorff, where they are at all equivocal, are anxiously investigated, and sometimes involved in additional obscurity; while, in the mean time, the science of natural jurisprudence [substitute human mind], never advances one single step; but, notwithstanding its recent birth, seems already sunk into a state of dotage.'

All this, when applied to Scottish metaphysics, is strikingly just and happily expressed. It is now ascertained that the opinion of Dr. Brown concerning Mr. Stewart as a metaphysician was essentially the same as that expressed of Dr. Reid; and that, in demolishing the claims of the one, he was, without avowedly doing it, actually

battering down the pretensions and erections of the other. Dr. Brown's book may then (as Montesquieu said of that of Cervantes), be considered the best of the kind yet produced in Scotland, not only abstractedly viewed, but because it so effectually exposes the absurdity of all the rest. He says, in a letter to Mr. Erskine (Life of Dr. Brown, p. 195), 'I was very much constrained, as you may believe, by the unpleasantness of differing so essentially from Mr. Stewart, on many of the principal points. But I conceived that it would be more honorable to state at once my own opinions, than to seem to introduce them afterwards in other years; and Dr. Reid's name fortunately served every purpose, when I had opinions to oppose in which Mr. Stewart perhaps coincided. I got off, therefore, pretty well in that way; though I must confess that it was one of the most unpleasant circumstances attending my situation.'

For Mr. Stewart, as an elegant scholar, an excellent man, a friend of civil and religious liberty, and of human improvement and happiness, we have the highest respect and regard; but, next to sophistry, we do hate, from our inmost soul, all learned and philosophic pretensions and cant. These are the entities towards which our uncompromising and unsparing hostility is directed; and, if we could encounter them in a state of pure metaphysical abstraction, we would gladly escape from the unwelcome and painful task of dealing with them in their concrete form. If they have no existence in connexion with Mr. Stewart—if they are not embodied in his writings (and we have no personal knowledge of him), we have wronged him, and would, upon convincement of our guilt, willingly make any atonement in our power;—but even in this case we have sinned, not wantonly, but ignorantly: it was in truth with extreme and very painful reluctance that we wrote what we have written.

As the expressions, experimental induction, &c., 'are constantly recurring in an eternal circle,' throughout the Dissertations of Mr. Stewart, we quote the following just remark from those of Mr. Playfair which are so admirable in almost every respect. 'The experimentum crucis,' says Mr. Playfair, 'is of such weight in matters of induction, that in all those branches of science where it cannot be easily resorted to (as agriculture, medicine, political economy, &c.)—[that metaphysics is included, no reasonable person can doubt], there is often a great want of conclusive evidence. Hence the great difficulty of separating the causes, and allotting to each its due proportion of the effect. Men deceive themselves in consequence of this continually, and think they are reasoning from facts and experience, when in reality they are only reasoning from a mixture of truth and falsehood. The only end answered by facts, so incorrectly apprehended, is that of making error more incorrigible.'

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It is supposed that a medical course of study is favorable to metaphysical intellect. We lay no stress on this; though there is probably considerable tendency in the one to the other, as there is certainly a sort of natural connexion between the physical and metaphysical study of man; or between the physiology of the human frame, and what some have recently named the physiology of mind. Locke and Hartley, as well as Dr. Brown, were physicians. Dr. Brown, however, had a metaphysical bias before he studied medicine with a view to a profession. The latter no doubt acted powerfully, and in some respects favorably, on the former. There was another early, and which proved a permanent bias of his mind—which would seem at first sight not very favorable to, or compatible with the other, though it existed also in the singular mind of Hobbes—a poetic turn or tendency, if we may not call it genius. Certain it is, from both examples of the union of a metaphysical and a poetical bias, that, if the latter was not unfavorable to the former, the metaphysical was decidedly unfavorable to the poetical energy of the mind. We think that this might be easily and perhaps satisfactorily accounted for. This, however, is not our present business; suffice it to remark, that Brown, Hobbes, Bacon, (as all men possessed of high degrees of intellectual vigor) would seem to have been as truly possessed ab origine of the poetical genius (that is a powerful and active imagination) as Shakspeare, Milton, Homer, and Virgil, but subsequent circumstances made the ultimate distinction as to intellectual character. We proceed to give some account of Dr. Brown's lectures.

The first is introductory; and we select from it the following remarks as the most essentially important. Having remarked on the futility and absurdity of the metaphysics of the schoolmen, he adds:—'The progress of intellectual philosophy may indeed, as yet, have been less considerable than was to be hoped under its present better auspices. But it is not a little to have escaped from a labyrinth, so very intricate and so very dark, even though we should have done nothing more than advance into sunshine and an open path, with a long journey of discovery still before us. We have at last arrived at the important truth, which now seems so very obvious a one, that the mind is to be known best by observation of the series of changes which it presents, and of all the circumstances which precede and follow these. * * * The mind, it is evident, may like the body to which it is united, or the material objects which surround it, be considered as a substance possessing certain qualities, susceptible of various affections or modifications, which, existing successively as momentarily states of the mind, constitute all the phenomena of thought and feeling. The general circumstances in which these changes of state succeed each other, or, in other words, the laws of their succession, may be pointed out, and the phenomena arranged in various classes, according as they may resemble each other, in the circumstances that precede or follow them, or in other circumstances of obvious analogy. There is, in short, a science that may be termed mental physiology, as there is another science relating to the structure and offices of our corporeal frame, to

which the term physiology is more commonly applied; and as by observation and experiment we may endeavour to trace those series of changes which are constantly taking place in our material part, from the first moment of animation to the moment of death; so, by observation, and in some measure also by experiment, we endeavour to trace the series of changes that take place in the mind, fugitive as these successions are, and rendered doubly perplexing by the reciprocal combinations into which they flow. * * * *

'There is a philosophic spirit which is far more valuable than any limited acquirements of philosophy; and the cultivation of which, therefore, is the most precious advantage that can be derived from the lessons and studies of many academic years; a spirit which is quick to pursue whatever is within the reach of human intellect; but which is not quick to discern the bounds that limit every human enquiry, and which, therefore, in seeking much, seeks only what man may learn: which knows how to distinguish what is just in itself, from what is merely accredited by an illustrious name; adopting a truth which no one has sanctioned, and rejecting an error of which all approve, with the same calmness as if no judgment were opposed to its own: but which, at the same time, alive with congenial feelings to every intellectual excellence, and candid to the weakness from which no excellence is wholly privileged, can dissent and confute without triumph, as it admires without envy; applauding gladly whatever is worthy of applause in a rival system, and venerating the very genius which it demonstrates to have erred.'

The second lecture is entitled Relation of the Philosophy of Mind to the Sciences; and the office of intellectual science is magnified with considerable effect; but there is nothing very worthy of being extracted, except the following sentence which contains the germe of the whole lecture, and which it is possible some minds require to have impressed upon them.

'To the philosophy of mind every speculation, in every science, may be said to have relation as to a common centre. The knowledge of any quality of matter, in the whole wide range of physics, is not itself a phenomenon of matter, more than the knowledge of any of our intellectual or moral affections; it is truly, in all its stages of conjecture, comparison, doubt, belief, a phenomenon of mind; or, in other words, it is only the mind itself existing in a certain state.'

The third lecture, entitled Influence of the Philosophy of Mind on the Understanding, points out, as is done in Locke's Essay, the importance of knowing the limits of our faculties, that we may attempt only possible knowledge and profitable enquiries; and the tendency of intellectual science to render us candid, tolerant, and liberal, towards those who differ from us in opinion, with its advantages to education, criticism, &c.

The fourth lecture, entitled Relation of the Philosophy of Mind to Morality, contains many good remarks, but nothing very new or remarkable.

The fifth and sixth lectures, Of Physical Enquiry, seem foreign to metaphysical discussion They contain, however, some important remarks such as the following:—'All physical science, whatever may be the variety of objects, mental or material, to which it is directed, is nothing more than the comparison of phenomena, and the discovery of their agreement or disagreement, or order of succession. It is on observation, therefore, or on consciousness, which is only another name for internal observation, that the whole of science is founded; because there can be no comparison without observation of the phenomena compared, and no discovery of agreement or disagreement without comparison. * * * What is it that we truly mean, when we say that we are about to enquire into the nature and properties of any substance? From the mere misunderstanding of this question, the brightest talents of a long succession of ages were wasted in enquiries as barren as the frivolous glory which attended them; that produced indeed much contention and more pride, but nothing more; and, without giving any additional knowledge, took away from ignorance only its humility, and its power of being instructed.'

The intention of these two lectures was to correct the scholastic notions, or rather to cancel the scholastic jargon about substance or matter; and though not very definite, lucid, or available for any important purpose, they are more successful than Locke's attempts of the same kind. 'Whenever the question is put as to any object, What is it? there are two and only two answers, that can be given with meaning. We may regard it as it exists in space, and state the elements that coexist in it, or rather that constitute it; or we may regard it as it exists in time, and state, in all the series of changes of which it forms an invariable part, the objects to which it is related as antecedent.' This is the text which the whole discussion labors to explain, illustrate, and establish.

The seventh lecture is on Power, Cause, and Effect, concerning which there has been so much said and written by men who frequently knew not what they said, or whereof they either affirmed, or denied, or disputed. Dr. Brown adopts, with a slight and unimportant difference, the statement of Hume, the latter resolving our belief as to the relation between cause and effect, or antecedent and consequent, into custom; the former into an original principle or tendency of our intellectual constitution. The doctrine of Hume was long regarded with horror by most theists as essentially atheistical; but it begins to be regarded as not only correct, but as having nothing necessarily atheistical about it; nay, it is now found or fancied by some of them to be one of the most powerful of all antidotes to atheism. 'If,' says Mr. Stewart, 'it be true, as Mr. Hume contends, and as most philosophers now admit, that physical causes and effects are known to us merely as antecedents and consequents, the whole system of Spinoza is nothing better than a rope of sand, and the very proposition which it professes to demonstrate is incomprehensible by our faculties. Mr. Hume's doctrine, in the unqualified form in which he states it, may lead to other consequences not less dangerous; but, if he had not the good fortune to lead metaphysicians

to the truth, he may at least be allowed the merit of having shut up for ever one of the most frequented and fatal paths which led them astray. It was, so far as I know, first shown in a satisfactory manner by Mr. Hume, that every demonstration which has been produced for the necessity of a cause to every new existence, is fallacious and sophistical. In illustration of this assertion, he examines three different arguments which have been alleged as proofs of the proposition in question; the first by Mr. Hobbes, the second by Dr. Clarke, and the third by Mr. Locke. And I think it will now be readily acknowledged, by every competent judge, that his objections to all these pretended demonstrations are conclusive and unanswerable.'

'To know the powers of nature,' says Dr. Brown, 'is nothing more than to know what antecedents are, and will be followed by what consequents; for this invariableness and not any distinct existence is all which the shorter term power, in any case expresses. By an original law or principle of our constitution, we are led from the mere observation of change to believe, that, when similar circumstances occur, the changes which we observe will also recur in the same order; there is hence conceived by us to be a permanent relation of one event, as invariably antecedent to another event, as invariably consequent; and that this permanent relation is all which constitutes power. It is a word, indeed, of much seeming mystery; but all which is supposed to be mysterious and perplexing in it vanishes, when it is regarded in its true light as only a short general term expressive of invariable antecedence; or, in other words, of that which cannot exist in certain circumstances, without being immediately followed by a certain definite effect, which we denominate an effect in reference to the antecedent, which we denominate a cause. To express, shortly, what appears to me to be the only intelligible meaning of the three most important words in physics, immediate, invariable, antecedent, is power; the immediate invariable antecedent, in any sequence, is a cause; the immediate invariable consequent is the correlative effect.'

We know not what other intelligible account can be given of the matter; nor do we perceive how it is possible for any thing necessarily atheistical to lurk in the statement; though we know that there are many good men of very respectable intellect, whom it would be difficult, if at all practicable, to convince that it is perfectly safe and sound. It would have been well if Dr. Brown had relied less on abstract and elaborate argumentation, and if he had proceeded more on the principle of confuting error, or of dispelling mental confusion by tracing it to its source in words; for such words as power, cause, effect, are mere relics of expressions or sentences, which were sufficiently explicit; but when reduced, abridged, or contracted, into what are called nouns, these relics of former expressions become the occasion of much error and metaphysical mystery and prejudice. Thus by substituting antecedent for cause, and consequent for effect, the work is in effect done on which so much elaborate argument has been expended, to prove, that is to bring men to admit, that there is nothing else and can be nothing else meant by them in using the word cause, but what is meant by antecedent. The word power is more difficult, because we happen to have no word that seems eligible or admissible as a substitute. In such a case it would be wise to throw away the apple of discord at once rather than eternally dispute about it. Dr. Brown virtually adopts what we consider the best method of ridding the world of metaphysical confusion and unprofitable controversy. 'That power,' he says, 'is nothing more than the relation of an object or event as antecedent to another object or event, its immediate and invariable consequent, may perhaps, from the influence of former habits of thought, or rather, of former abuse of language (or using it without any distinct meaning), at first appear to you an unwarrantable simplification. But the longer you attend to the notion, the more clearly will you perceive that all which you have ever understood in it, is the immediate sequence of some change with the certainty of the future recurrence of this effect as often as the antecedent itself may recur in similar circumstances. When a spark falls upon gunpowder, every one ascribes to the spark the power of kindling the inflammable mass. But let any one ask himself what he means by the term, and he will find nothing more than this, that in all similar circumstances the explosion of gunpowder will be the immediate and uniform consequence of the application of a spark.'

After the elaborate lecture on power, cause, and effect, there is nothing very worthy of notice till we come to the sixteenth lecture on the Classification of the Phenomena of Mind. In the intermediate ones there is abundance of things, or more properly, perhaps, nothings, treated of; but little that is said concerning them is very tangible, or very available. He tells us that 'analysis in the science of mind is founded wholly on the feeling of relation which one state of mind seems to us to bear to other states of mind as comprehensive of them;' that 'it has been strangely affirmed of the science of mind, that it is by its very nature insusceptible of improvement by discovery;' that 'there is indeed a chaos in the mind of man, but there is a spirit of enquiry for ever moving over it, slowly separating all its mingled elements; and it is only when these are separated that the philosophy of mind can be complete, and incapable of further discovery;' that 'mind is capable of existing in various states, an enumeration of the leading classes of which is all that constitutes our definition of it;' that 'the consideration of the mind, as one substance, capable of existing in a variety of states necessarily involves the consideration of consciousness and of personal identity;' that 'consciousness (which has a large tribute of lecture), is not, as Dr. Reid and his disciples maintain, a distinct power of the mind (and truly for the same reason that they make the obscure word consciousness into a power, they might create with the breath of their mouth a thousand powers or potentates in the mind, or rather in the nomenclature of their infallible, experimental, inductive

science), but only a general term for all our feelings of whatever species these may be—sensations, thoughts, desires; in short all those states or affections of mind in which its phenomena consist;' that 'conscience, which is not to be confounded with consciousness is moral memory, or the memory of the heart;' that 'the enquiry into the identity of the mind (he gives up personal identity in despair) as truly one and permanent amid all the variety of its fugitive affections, is a most important enquiry;' that 'the manner in which the mind is united to a system of particles, which are in a perpetual state of flux, is indeed more than we can ever hope to explain;' that 'our identity is the unity and sameness of that which thinks and feels; and the 'belief of our identity is intuitive and irresistible' (this, after a long, laboring, winding, slow process of reasoning, that would try the patience of Locke himself, is the result or sum total of discovery from the most important enquiry); that 'it is beyond our power to solve the question, how much the mere materialism of our language has operated in darkening our conceptions of the nature of the mind and of its various phenomena;' that 'it is a very egregious paradox of Locke in making personal identity consist in consciousness;' that 'it is a very shrewd remark of a French writer: if truth were fairly to show herself as she is, all would be ruined; but it is plain that she knows very well of how great importance it is that she should keep herself out of sight.' This is surely humbling enough to metaphysics—only to resign 'personal identity,' and to confess truth 'out of sight.'

The following are the most noticeable items of lectures sixteenth, seventeenth, and eighteenth, on the Classification of the Phenomena of Mind.

'The great leading division of the mental phenomena which has met with most general adoption by philosophers (and who besides ever troubled their heads about such outlandish entities as phenomena?), is into those which belong to the understanding, and those which belong to the will; a division which is very ancient, but though sanctioned by the approbation of many ages very illogical; since the will, which, in the division is nominally opposed to the intellect, is so far from being opposed to it in reality, that, even by the assertors of its diversity, it is considered as exercising in the intellectual department, an empire almost as wide as in the department allotted to itself. We reason, and plan, and invent, at least as voluntarily, as we esteem, or hate, or hope, or fear. How many emotions are there too which cannot, without absolute torture, be forced into either division. To take only a few instances out of many, to what class are we to reduce grief, joy, admiration, astonishment, which certainly are not phenomena of the mere understanding, and which, though they may lead indirectly to desires or volitions, have nothing in themselves that is voluntary, or that can be considered as in any peculiar degree connected with the will? The division of the mental phenomena into those which belong to the understanding, and those which belong to the will, seems, therefore, to be as faulty as would be the division of animals into those which have legs and those which have wings, since the same animals might have both legs and wings, and since all tribes of animals have neither one nor the other.'

That strain was of a higher mood! The lecturer is himself again! When he does not trifle among nullities and unideal abstractions, or attempt to go beyond the length of his line (as Mr. Stewart not very seemly or graciously remarks) he acquits himself nobly. Though he often fails in attempting to build up any thing new, as positive knowledge in the science of mind, he is always skilful, and dexterous, and mighty, in pulling down philosophic nonsense and absurdity. But let him proceed.

'Another division of the phenomena of mind, similar to the former, and of equal antiquity, since it corresponds with the very ancient division of philosophy into the contemplative and the active, is into those which belong to the intellectual powers, and those which belong to the active powers. This division of the mental phenomena as referrible to the intellectual and the active powers of the mind, though it has the sanction of very eminent names (as Dr. Reid and his disciples) is faulty exactly in the same manner as the former, which, indeed, it may be considered almost as representing under a change of name. Its parts are not opposed to each other, and it does not include all the phenomena which it should include. Is mere grief, for example, or mere astonishment, to be referred to our intellectual or to our active powers? I do not speak of the faculties which they may or may not call into action; but of the feelings themselves, as present phenomena or states of the mind. And, in whatever manner we may define the term active, is the mind more active when it merely desires good, and fears evil? when it looks with esteem on virtue, and with indignation or disgust and contempt on vice, than when it pursues a continued train of reasoning or fancy, or historical investigation? * * * So little, indeed, are the intellectual powers opposed to the active, that it is only when some intellectual energy co-exists with desire that the mind is said to be active, even by those who are unaccustomed to analytical enquiries, or to refinements of metaphysical nomenclature. The love of power, or the love of glory, where there is no opportunity of intellectual exertion, may, in the common acceptation of the word, be as passive as tranquillity itself. The passion is active only when, with intellectual action, it compares means with ends, and different means with each other, and deliberates, and resolves, and executes.' * * *

'If, then, as I cannot but think, the arrangement of the mental phenomena, as belonging to two classes of powers, the intellectual and the active, be at once incomplete and not accurate even to the extent to which it reaches, it may be worth while to try, at least, some other division, even though there should not be any very great hope of success. Though we should fail in our endeavour to obtain some more precise and comprehensive principle of arrangement, there is always some advantage gained by viewing objects according to new circumstances of agreement or analogy. We see, in this case, what

had long passed before us unobserved, while we were accustomed only to the order and nomenclature of a former method; for, when the mind has been habituated to certain classifications, it is apt in considering objects to give its attention only to those properties which are essential to the classification, and to overlook, or at least comparatively to neglect, other properties equally important and essential to the very nature of the separate substances that are classed, but not included in the system as characters of generic resemblance. * * * A new classification, therefore, which includes in its generic character those neglected qualities, will, of course, draw to them attention which they could not otherwise have obtained; and, the more various the views are which we take of the objects of any science, the juster consequently, because the more equal, will be the estimate which we form of them.'

We wish our space would permit us to extract more; the whole context is excellent. We must give one other quotation:—

'It may, perhaps, seem absurd, even to suppose, that we should think ourselves able to change, by a few generic words, the properties of the substances which we have classed; and if the question were put to us, as to this effect of our language in any particular case, there can be no doubt that we should answer in the negative, and express astonishment that such a question should have been put. But the illusion is not the less certain because we are not aware of its influence; and, indeed, it could no longer be an illusion, if we were completely aware of it. It requires, however, only a very little reflection on what has passed in our own minds, to discover that when we have given a name to any quality, that quality acquires immediately, in our imagination, a comparative importance, very different from what it had before; and, though nature in itself be truly unchanged, it is ever after, relative to our conception, different; a difference of words is, in this case, more than a verbal difference. Though it be not the expression of a difference of doctrine, it very speedily becomes so. Hence it is, that the same warfare which the rivalries of individual ambition, or the opposite interests, or supposed opposite interests of nations have produced in the great theatre of civil history, have been produced, in the small but tumultuous field of science by the supposed incompatibility of a few abstract terms; and, indeed, as has been truly said, the sects of philosophers have combated with more persevering violence to settle what they mean by the constitution of the world, than all the conquerors of the world have done to render themselves its masters. Let us now endeavour to form some better classification of the mental phenomena than has hitherto existed.

'Our states of mind, or our affections of mind, are the simplest terms which I can use to express the whole series of mental phenomena in all their diversity, without any mixture of hypothesis as to the particular mode in which the successive changes may be supposed to arise. When we consider these various states or affections of mind which form the series, one obvious circumstance of difference is, that some of them arise immediately, in consequence of the presence of external objects; and some as immediately in consequence of certain preceding states or affections (for the latter term is here used as exactly synonymous with the former) of the mind itself.

'There is then one obvious distinction of the mental phenomena in relation to their causes as external and internal. We shall therefore call the one class external states or affections of the mind, and we shall call the other internal states or affections, merely in reference to their immediate causes or antecedents. The former class (our external affections) is so simple as to require but little subdivision: the latter class (our internal affections or states of mind) comprehends so large a proportion of the mental phenomena, and these so various, that it requires subdivisions to enable us to derive any benefit from arrangement or classification.

'The first great subdivision of our internal affections which I would make is into our intellectual states and our emotions. The latter of these classes (our emotions) comprehends all or nearly all the mental states by others classed under the head of active powers, and commonly called affections and passions.

'We have sensations or perceptions of the objects around us that affect our bodily organs; these I term the sensitive or external affections of the mind: we remember objects—imagine them in new situations—we compare their relations; these mere conceptions or notions of objects, and their qualities as elements of our general knowledge, are what I term the intellectual states of the mind: we are moved with certain feelings on the consideration of what we thus perceive or remember, or imagine, or compare, with feelings for example to which we apply the terms beauty, sublimity, astonishment, love, hate, hope, fear &c.; these are what I mean by our emotions.

'There is no portion of our consciousness which does not appear to be included in one or other of these three divisions. To know all ou sensitive states or affections, all our intellectual states, and all our emotions, is to know all that we call the mental phenomena.

'It must not be supposed, however, that these different mental states, though as we conceive distinguishable, may not be combined or may not coexist at the same moment. They frequently concur, but in all cases in which they do concur or co-exist it is easy to distinguish them by reflective analysis.'

We have made some slight change of Brown's phraseology and verbal arrangement with the desire rather than the hope of simplifying, concentrating, and lucidising his statement; but perhaps we have rather marred than mended the matter. It would have been better probably either to have done more or nothing. And we think it possible to render the expression of even such abstract meaning more simple, clear, and definite, than has been accomplished by our author. Perhaps his general threefold classification may be all expressed by the three words sensation, intellection, and emotion; or in the plural, sensations, intellections, and emotions; which is after all very much the same as has been long in existence, answering to the senses, the intellects, and the

passions We think Dr. Brown's attempt is so far successful as to have some negative utility; it is at least calculated to rid the world of some absurd forms of speech and not a little foolish theory, and pretension, and parade, or, to use an ugly but forcible expression, philosophic humbug about the intellectual powers and faculties, which as arrayed by Reid, Stewart, and Kant, may be called legion, for they are many.

Whether Dr. Brown's statements have real worth, or be, after all their analytical acuteness, ingenuity, and dexterity, only like,

—The rhetorician's rules
Which serve him but to name his tools,

they are at least simplicity, and beauty, and reasonableness in perfection, when compared with the cumbrous, complex doctrines of Reid and Stewart. And notwithstanding all the sage counsels, and tart sarcasms, and indefatigable remonstrances on the subject, simplicity, all other things being equal (and it would be prudent perhaps for some of the lovers of complication to say less about depth and comprehension), is an eternal and immutable excellence.

O! how unlike the complex ways of man
Heaven's artless, easy, unincumbered plan!
—Like the cerulean arch you see
Majestic in its own simplicity.

He his fabric of the heavens
Hath left to their disputes, perhaps to move
His laughter at their quaint opinions wide,
Hereafter, when they come to model heaven
And calculate the stars, how they will wield
The mighty frame; how build, unbuild, contrive
To save appearances,—how gird the sphere,
With centric and eccentric scribbled o'er
Cycle and epicycle, orb in orb.

'As far as we have advanced,' says Dr. Brown, 'our division seems sufficiently distinct and comprehensive. The mind is susceptible of certain external affections, of certain intellectual modifications which arise from these, and of certain emotions which arise from both; that is to say it is capable of existing in certain states, the varieties of which correspond with these particular designations. We see, we remember, or compare what we have seen: we regard what we see, or remember, or compare, with desire or aversion; and of these, or of states analagous to these, the whole of life, sensitive, intellectual, or moral, is composed. Every minute, therefore, of every hour, in all its variety of occupation, is but a portion of this complicated tissue.'

This may be general, but it is extremely intelligible: it may be a theory, but it possesses a sort of internal evidence of genuineness, or that it is the true theory which almost irresistibly produces intuitive belief; for it is a perfect contrast to the old systems of the mind full of quaint device, and manifestly contrived to save appearances, and 'scribbled o'er,' with names and definitions as unintelligible as Egyptian hieroglyphics.

'You will remember,' repeats our author, 'that the various affections of which the mind is susceptible are either external, as they arise from causes without the mind, or internal, as they arise from previous states of the mind itself; that of these internal affections, some are mere conceptions or notions of former feelings, or of objects and of the qualities or relations of objects, as remembered or variously combined or compared,—results of different susceptibilities of our intellectual constitution, to which different names have been given, conception, memory, imagination, abstraction, reason, and other synonymous terms; that these internal affections or states of mind which I have denominated its intellectual states, are distinctly separable in our reflective analysis, from certain vivid feelings, that may arise instantly in the mind on the consideration of these mere intellectual results, or on the perception of objects without feelings of admiration, love, desire, and various other analogous or opposite states of the mind; but that there is such an order of vivid feelings, which arise, in many cases, on the mere consideration of what we perceive, or remember, or imagine, or compare: and that this order is what I wish to be distinguished by the name of emotion.

'According to this division of the mental phenomena, into those which are of external and those which are of internal origin, and the subdivision which we have made of this latter class, I shall proceed to consider, 1. The external powers or susceptibilities of the mind; 2. The intellectual powers or susceptibilities of the mind; and, 3. Its susceptibilities of emotion,—beginning with that class which we have every reason to suppose to be first, in the actual order of development, the powers or susceptibilities of the mind, in its immediate relation to its own bodily organs.'

Our limits will not permit us to attempt to follow Dr. Brown through his long, laboring, winding, and we think irksome discussion, concerning what he terms the external affections of the mind. It partakes too much of almost every kind of excellence, save simplicity, clearness, conclusiveness, and availableness. He is in short too acute, and subtile, and dexterously analytic in such matters to be always convincing or generally plausible. The mind is haunted with suspicions of the soundness of his statements at every step of his progress; and yet we think most of them possess more of probability than our understanding is disposed to allow from the over refined and untangible manner in which they are presented. Dr. Brown, however, in this part of his lectures is like Hartley, Locke, and almost all his metaphysical predecessors, too much infected with the old scholastic complaint of attempting impossible demonstration, and of adventuring with daring perversity on the forlorn hope of unprofitable speculation. He strives most mightily to go beyond the length of his tether, to adopt an allusion of his Herculean ancestor, which is certainly more remarkable for vernacular significance than for classical elegance. We think it almost more than probable that we learn or did learn the use of our senses in much the same manner as we learned the use of our hands and feet, and tongue, pronounced by the highest authority our glory; that it was by a gradual (though not so slow a) process that we became capable of seeing, and hearing, and feeling, and even tasting, and smelling, as well as of handling, and walking, and speaking. But what

then, how are we to arrive at demonstrative, inductive, experience, or intuitive certainty? And if we could arrive at infallible knowledge after much laborious toil and search after it, what the wiser, or better, or happier, should we be for the acquisition? It comes too late to be of any use, were it as sure and satisfactory, philosophically considered, as the Newtonian system of the universe. If we can find out by metaphysical research or analysis that our mental identity is to have the benefit of a second edition of this life, by being transmigrated into the body of an embryo or new-born infant, the lengthy and ingenious discussion of Dr. Brown may be of great practical utility as well as high speculative importance. In every other view we know not what benefit is to be derived from nearly the whole of Dr. Brown's seventeenth, eighteenth, nineteenth, twentieth, twenty-first, twenty-second twenty-third, and twenty-fourth lectures. They may indeed amuse some sorts of leisure minds, or fill up some empty space in college studies. However we shall endeavour to glean a few of the most noticeable or seemingly available remarks as specimens.

'In what circumstances the intuitive belief of an external world (if it be intuitive) arises, or rather in how large a proportion of cases, in which the reference seems primary and immediate, it is more probably the effect of secondary associations transferred from sense to sense, will appear better, on minute analysis of the different tribes of sensations.' 'The great essential organ of all sensations is the brain, with its appendages, particularly the nerves that issue from it to certain organs, which are more strictly termed the organs of sense; as it is there the immediate objects, or external causes of sensation, the particles of light, for example, in vision, or of odor in smell arrive, and come, as it were, into contact with the sensorial substance. The nervous matter has for its chief seat the great cavity of the head, but extends by innumerable ramifications over the whole surface, and through the internal parts of the body. Of the nature of the connexion of this great sensorial organ with the sentient mind we shall never be able to understand more than is involved in the simple fact, that a certain affection of the nervous system precedes immediately a certain affection of the mind.'

The conclusion intuitively arising from a thousand such remarks is that nothing can be concluded: Dr. Brown, with all his physiological and metaphysical ability, has left our senses and sensation just about where he found them; and he would have acted more judiciously perhaps if he had let them alone altogether. The twenty-fifth, twenty-sixth, twenty-seventh, and twenty-eighth lectures, are devoted to the confutation of Dr. Reid's supposed confutation of idealism; and, though Mr. Stewart had been indefatigably employed for almost half a century in building up the metaphysical claims of his master, Dr. Brown demolishes them in toto most triumphantly, convicting the Socrates of the Scottish metaphysic, or true philosophy of the human mind, of much 'zealous blundering;' which having been put confidently forth by himself, and clamorously applauded by his disciples, almost passed even beyond the borders for profound wisdom.

The twenty-ninth lecture is devoted to vision, which ought to have been disposed of among the other senses; but which, on account of its preeminent importance, was probably deemed worthy of standing alone and far apart, at least in discussion, from the less noble senses of hearing, tasting, smelling, and feeling. All Dr. Brown's remarks upon it are ingenious, and many carry in them much that is probable if not convincing.

'Vision,' says the lecturer, 'simple, and immediate, as it now seems to us, even in its most magnificent results, is truly the application of an art, of long and tedious acquirement, of that art with which we learn to measure forms and distances, with a single glance, by availing ourselves of the information previously received from other sources; the mixed product of innumerable observations, and calculations, and detections of former mistakes, which were the philosophy of our infancy, and each of which, separately, has been long forgotten, recurring to the mind, in after life, with the rapidity of an instinct.'

The thirtieth lecture is devoted to the history of opinions regarding perception, including those of the peripatetics, of Descartes, of Malebranche, of St. Austin, of Leibnitz. The discussion is chiefly interesting as exhibiting the error, prejudice, and folly, from which we have at last escaped. 'From all this variety of conjectural speculations (says the lecturer) the conclusion is, that which is too often the result of our researches in the history of science, that there may be, as D'Alembert truly says, a great deal of philosophising in which there is very little of philosophy.'

The external affections, as combined with desire and with attention, are considered in the thirty-first lecture; which however contains nothing very worthy of remark.

The thirty-second lecture treats of the classification of the internal affections; but contributes hardly any thing that can be regarded as information or instruction. The following remark is worth quoting:—'The philosophy of Dr. Reid and of the metaphysicians of this part of the island has enlarged far beyond what was necessary the number of classes of the mental phenomena, which they considered as too limited before. There can be no doubt that we are now accustomed to speak of more powers or operations of the mind, than even the schoolmen themselves, fond as they were of all the nicest subtilties of infinitesimal subdivisions.' According to Dr. Brown's statement, Condillac, the head of the French school of metaphysics, and Dr. Reid, the head of the Scottish school, may be regarded as metaphysical antipodes or opposite points, each in the extreme from the centre; Condillac erring by undue simplicity in representing all the mental states or operations as merely transformed sensation, as he terms them; and Dr. Reid erring on the opposite extreme of complexity, by multiplying unnecessarily intellectual powers and faculties. Condillac and Hartley may be regarded as homogeneous; and Reid and Kant, so far at least as multiplication of powers, faculties, and innate or instinctive principles are concerned.

In the thirty-third and subsequent lectures Dr. Brown proceeds with the internal states or affections; and we only regret the narrowness of our limits in reference to them; for they are exceedingly interesting. We shall try to accomplish multum in parvo.

'Our various states or affections of the mind I have already divided into two classes, according to the nature of the circumstances which precede them,—the external and the internal; and this latter class into two orders,—our intellectual states of mind, and our emotions. It is with the intellectual states or phenomena that we are at present concerned; and this order I would arrange under the generic capacities, that appear to comprehend in them all the phenomena of the order. The whole order, as composed of feelings, which arise immediately, in consequence of certain former feelings of the mind, may be technically termed, in reference to these feelings which have induced them, suggestions, but in the suggested feelings themselves there is one striking difference. If we analyse our trains of thought, exclusively of the emotions which may coexist or mingle with them, and of sensations that may be accidentally excited by external objects, we shall find them to be composed of two very distinct sets of feelings, one set of which are mere conceptions or images of the past, that rise, image after image in regular sequence, but simply in succession, without any feeling of relation necessarily involved, while the perception of relation, in the various objects of our thoughts, form another set of feelings, of course as various as the relations perceived,—perceptions and relations; it is with these, and with these alone, that we are intellectually conversant. There is thus an evident ground for the arrangement of the internal suggestions, that form our trains of thought, under two heads, according as the feeling excited directly by some former feeling may be either a simple conception, in its turn, perhaps, giving place to some other conception as transient; or may be the feeling of a relation which two or more objects of our thoughts are considered by us as bearing to each other. There is in short, in the mind, a capacity of association; or as, for reasons afterwards to be stated, I would rather term it,—the capacity of simple suggestion, by which feelings, formerly existing, are revived in consequence of the mere existence of other feelings, as there is also a capacity of feeling, resemblance, difference, proportion, or relation in general, when two or more external objects, or two or more feelings of the mind itself, are considered by us; which mental capacity, in distinction from the former, I would term the capacity of relative suggestion; and of these simple and relative suggestions, our whole intellectual trains of thought are composed.

'The intellectual states of the mind, then, to give a brief illustration of my division, I consider as all referrible to two generic susceptibilities, those of simple suggestion and relative suggestion. Our perception or conception of one object excites of itself, and without any known cause external to the mind, the conception of some other object; as when the mere sound of our friend's name suggests to us the conception of our friend himself, in which case the conception of our friend, which follows the perception of the sound, involves no feeling of any common property with the sound which excites it, but is precisely the same state of mind which might have been induced by various other previous circumstances; by the sight of the chair on which he sat, of the book which he read to us, of the landscape which he painted. This is simple suggestion.

'But, together with this capacity of simple suggestion, by which conception after conception arises precisely in the same manner, and in the same state, as each might have formed a part of other trains, and in which the particular state of mind that arises by suggestion does not necessarily involve any consideration of the state of mind which preceded it; there is a suggestion of a very different sort, which in every case involves the consideration not of one phenomenon of mind, but of two or more phenomena, and which constitutes the feeling of agreement, disagreement, or relation of some sort. I perceive, for example, a horse and a sheep at the same moment. The perception of the two is followed by that different state of mind which constitutes the feeling of their agreement in certain respects, or of their disagreement in certain other respects. I think of the square of the hypothenuse of a right-angled triangle, and the squares of the two other sides;—I feel the relation of equality; I see a dramatic representation; I listen to the cold conceits which the author of the tragedy, in his omnipotent command over warriors and lovers of his own creation, gives to his hero, in his most impassioned situations; I am instantly struck with their unsuitableness to the character and the circumstances. All the intellectual successions of feelings in these cases, which constitute the perception of relation, differ from the result of simple suggestion in necessarily involving the consideration of two or more objects, or affections of mind, that immediately preceded them. I may think of my friend in the case of simple suggestions; that is to say, my mind may exist in the state which constitutes the conception of my friend without that previous state which constitutes the perception of the sound of his name; for the conception of him may be suggested by various objects and remembrances. But I cannot, in the cases of relative suggestion, think of the resemblance of a horse and a sheep; of the proportion of the squares of the sides of a right-angled triangle; or of the want of the truth of nature in the expressions of a dramatic hero, without those previous states of mind which constitute the conceptions of a horse and a sheep, of the sides of the triangle, or the language of the warrior or lover, and the circumstances of triumph, or hope, or despair, in which he is exhibited to us by the creative artist.

'With these two capacities of suggested feelings simple and relative, which are all that truly belong to the class of intellectual states of the mind, various emotions may concur, particularly that most general of all emotions, the emotion of desire in some one or other of its various forms. According as this desire does or does not concur with them, the intellectual states themselves ap-

pear to be different; and, by those who do not make the necessary analysis, are supposed therefore to be indicative of different powers. By simple suggestion, the images of things, persons, events, pass in strange and rapid succession; and a variety of names, expressive of different powers, conception, association, memory, have been given to this one simple law of our intellectual nature. But when we wish to remember some object; that is to say, when we wish our mind to be affected in that particular manner which constitutes the conception of a particular thing, or person, or event, or when we wish to combine new images, in some picture of fancy, this coexistence of desire with the simple course of suggestion, which continues still to follow its own laws, as much as when no desire existed with it, seems to us to render the suggestion itself different; and recollection, and imagination, or fancy, which are truly, as we shall afterwards find, nothing more than the union of the suggested conceptions, with certain specific permanent desires, are to us, as it were, distinct additional powers of our mind, and are so arranged in the systems of philosophers, who have not made the very simple analyses, which alone seem to me to be necessary for a more precise arrangement.

'In like manner those suggestions of another class, which constitute our notions of proportion, resemblance, difference, and all the variety of relations, may, as already remarked, arise, when we have had no previous desire of tracing the relations, or may arise after that previous desire. But, when the feelings of relation seem to us to arise spontaneously, they are not in themselves different from the feelings of relation that arise, in our intentional comparisons or judgments, in the longest series of ratiocination. Of ratiocination they are truly the most important elements. The permanent desire of discovering something unknown, or of establishing or confuting or illustrating some point of belief or conjecture, may coexist, indeed, with the continued series of relations that are felt, but does not alter the nature of that law by which these judgments or relative suggestions succeed each other. There is no new power to be found, but only the union of certain intellectual states of the mind, with certain desires, a species of combination not more wonderful in itself than any other complex mental state, as when we at the same moment see and smell a rose, or listen to the voice of a friend who has been long absent from us, and see at the same moment that face of affection which is again giving confidence to our heart and gladness to our very eyes.

'Our intellectual states of mind, then, are either those resemblances of past affections of the mind which arise by simple suggestion, or those feelings of relation which arise by what I have termed relative suggestions,—the one set resulting, indeed, from some prior states of the mind, but not involving, necessarily, any consideration of these previous states of mind, which suggested them; the other set necessarily involving the consideration of two or more objects, or two or more affections of the mind, as subjects of the relation which is felt.

'How readily all the intellectual states of mind, which are commonly ascribed to a variety of powers, may be reduced to those two, will appear more clearly after we have considered and illustrated the phenomena of each set.'

Dr. Brown proceeds to treat, first, of simple, and, secondly, of relative suggestion; and the discussion, which is one of the most important in the whole course, extends from the beginning of the thirty-fourth to the end of the forty-seventh lecture. We shall endeavour to shorten and simplify his statements, or rather to extract their essential excellence.

Simple Suggestion.—The term suggestion, as substituted for Locke's unhappy expression, association of ideas, seems to have been adopted from Berkeley, who had used it in much the same sense, or for much the same purpose. The following reasons are assigned for its preference and adoption. The limitation of the term association, to those states of mind exclusively denominated ideas, has tended greatly to obscure the subject, or at least to deprive us of the aid which might have been received from it in the analysis of the most complex phenomena. The influence of the associating principle extends not to ideas only, but to every species of affection of which the mind is susceptible. Joys, sorrows, and all the variety of emotions, are capable of being revived, in a certain degree, by the mere influence of this principle, and of blending with the ideas, or other feelings which awakened them, in the same manner as our conceptions of external things. These last, however, it must be admitted, present the most striking and obvious examples of the influence of the principle, and are therefore the fittest for illustrating it, as well as most calculated to arrest attention. The faint and shadowy elements of past emotions, as mingling in any present feeling, it may not be easy to distinguish; but our remembrances of things without are clear and definite, and are easily recognised as images of the past.

That, when two objects have been perceived in immediate succession or co-existence, the presence of the one will often suggest or call up the other (though that other, or a similar external cause, be not present), is that great fact of association or suggestion which we must admit, whatever opinion we may form with respect to its nature, or whatever name we may give to it. But is this fact to be resolved into a general tendency of the mind first operating at the moment of the suggestion itself, or to an earlier tendency, or principle, or law? The latter supposition would probably never have existed, but for the introduction of the ambiguous and inappropriate term association. It is the use of this unfortunate phrase (when a term so much simpler as suggestion might have been employed) which appears to have filled our intellectual systems with the names of so many superfluous powers. The supposed necessity, in our trains of thought, of some previous association, of course rendered it necessary that the conceptions ascribed to this cause should be such as before existed in a similar form, since, without this previous existence, they could not be supposed to admit of previous connexion; and, therefore,

when the suggestions were so very different, as to have the semblance almost of a new creation, it became necessary to invent some new power, distinct from that of association, to which they might be ascribed. What was in truth a mere simple suggestion, flowing from the same laws with other suggestions, became in this manner something more, and was ranked as a product of fancy, or imagination; nothing being so easy as the invention of a new name. A similar allusion gave rise to the supposition of various other intellectual powers, or at least favored greatly the admission of such powers, by the difficulty of accounting for suggestions, which could not have arisen from previous associations; and one simple power or susceptibility of the mind was thus metamorphosed into various powers, all distinct from each other, and distinct from that power of which they were only modifications.

That there is a tendency of ideas to suggest each other, without any renewed perception of the external objects which originally excited them, and that the suggestion is not altogether loose and indefinite, but that certain ideas have a peculiar tendency to suggest certain other relative ideas, in associate trains or bands of thought, is too familiar, as a general fact of our intellectual nature, to require to be illustrated by example. It is beautifully expressed by one of our most philosophic poets, Akenside:—

When the different images of things,
By chance combined, have struck the attentive soul
With deeper impulse, or, connected long,
Have drawn her frequent eye; howe'er distinct
The external scenes, yet oft the ideas gain
From that conjunction an eternal tie,
And sympathy unbroken. Let the mind
Recal one partner of the various league,
Immediate, lo! the firm confederates rise,
And each its former station straight resumes;
One movement governs the consenting throng,
And all at once with rosy pleasure shine,
Or all are saddened with the glooms of care.
* * * * * * * *
Such is the secret union, when we feel
A song, a flower, a name, at once restore
Those long connected scenes when first they moved
The attention. Backward, through her mazy walks,
Guiding the wanton fancy to her scope,
To temples, courts, or fields—with all the band
Of living forms, of passions, and designs
Attendant; whence, if pleasing in itself,
The prospect from that sweet accession gains
Redoubled influence o'er the listening mind;
By these mysterious ties, the busy power
Of memory her ideal train preserves
Entire; or, when they would elude her watch,
Reclaims their fleeting footsteps from the waste
Of dark oblivion.

What then are these mysterious ties?—or, to state the question more philosophically, what are the general circumstances which regulate the successions of ideas? That there is some regularity in these successions must have been felt by every one; and there are many references to such regularity in the works of philosophers of every age. The most striking ancient reference, however, to any general circumstances, or, as usually called, laws of suggestion (though the enumeration is rather hinted than developed), is that quoted by Dr. Beattie and Mr. Stewart from Aristotle. It is a passage explanatory of the process by which, in voluntary reminiscence, we endeavour to discover the idea of which we are in search. We are said to hunt for it (*θηρεύομεν*) among other ideas, either of objects existing at present, or at some former time; and from their resemblance, contrariety, and contiguity, *ἀπο τῦ νῦν, ἢ ἄλλυ τινὸς καὶ ἀφ' ὁμοίυ, ἢ ἐναντίυ ἢ τοῦ συνέγγυς. Διὰ τῦτο γινεταὶ ἡ αναμνησις.*

This brief enumeration of the general circumstances which direct us in reminiscence merits attention on its own account, and also on account of the very close resemblance it bears to the statement of Hobbes, and to the arrangement afterwards made by Hume. As Dr. Brown has intentionally, or unintentionally, omitted all mention of Hobbes in this connexion, we shall quote his words at some length. 'By consequence, or train of thoughts (Leviathan, part I. chap. iii., Of the Consequence or Train of Imaginations), I understand the succession of one thought to another, which is called, to distinguish it from discourse in words, mental discourse. When a man thinks on any thing whatsoever, his next thought after it is not altogether so casual as it seems to be. Not every thought to every thought succeeds indifferently. But as we have no imagination whereof we have not formerly had sense, or sensation, in whole, or in part; so we have no transition from one imagination to another, whereof we have never had the like before in our senses. The reason of which is this: all fancies are motions within us, relics of those made in the sense: and those motions that immediately succeed one another in the sense continue also together after sense: insomuch as the former coming again to take place, and to be predominant, the latter follows, by coherence of the matter moved, in such manner as water upon a plane table is drawn which way any one part of it is guided by the finger. But because in sense sometimes one thing, sometimes another, succeedeth, it comes to pass in time, that, in the imagination of any thing, there is no certainty what we shall imagine next: only this is certain, it shall be something that succeeded the same before, at one time or another.

This train of thoughts, or mental discourse, is of two sorts. The first is unguided, without design, and inconstant; wherein there is no passionate thought, to govern and direct those that follow, to itself, as the end and scope of some desire, or other passion: in which case the thoughts are said to wander, and seem impertinent one to another, as in a dream. Such are commonly the thoughts of men, that are not only without company, but also without care of any thing; though even then their thoughts are as busy as at other times, but without harmony; as the sound which a lute out of tune would yield to any man; or, in tune, to one that could not play. And yet, in this wild ranging of the mind, a man may ofttimes perceive the way of it, and the dependence of one thought upon another. For, in a discourse of our present civil war what could seem more impertinent than to ask, as one did, what was the value of a Roman penny? Yet the coherence to me was manifest

enough. For the thought of the war introduced the thought of the delivering up the king to his enemies; the thought of that, brought in the thought of the delivering up of Christ; and that again the thought of the thirty pence, which was the price of that treason; and hence easily followed that malicious question; and all this in a moment of time, for thought is quick.

'The second is more constant; as being regulated by some desire and design. For the impression made by such things as we desire or fear is strong and permanent, or, if it cease for a time, of quick return: so strong it is sometimes, as to hinder and break our sleep. From desire arises the thought of some means we have seen produce the like of that which we aim at; and, from the thought of that, the thought of means to that mean; and so continually, till we come to some beginning within our own power. And because the end, by the greatness of the impression, comes often to mind, in case our thoughts begin to wander, they are quickly again reduced into the way; which, observed by one of the seven wise men, made him give men this precept, which is now worn out, respice finem; that is to say, in all your actions, look often upon what you would have, as the thing that directs all your thoughts in the way to attain it.

'The train of regulated thoughts is of two kinds; one, when of an effect imagined we seek the causes, or means that produce it; and this is common to man and beast. The other is, when, imagining any thing whatsoever, we seek all the possible effects that can by it be produced; that is to say, we imagine what we can do with it when we have it. Of which I have not seen any sign but in man only; for this is a curiosity hardly incident to the nature of any living creature that has no other passion but sensual, such as hunger, thirst, lust, and anger. In sum, the discourse of the mind, when governed by design, is nothing but seeking, or the faculty of invention, which the Latins call sagacitas and solertia; a hunting out of the causes of some effect, present or past; or of the effects of some present or past cause. Sometimes a man seeks what he has lost; and, from that time and place wherein he misses it, his mind runs back from place to place, and time to time, to find where and when he had it; that is to say, to find some certain and limited time and place in which to begin a method of seeking. Again, from thence, his thoughts run over the same places and times, to find what action, or other occasion, might make him lose it. This we call remembrance, or calling to mind; the Latins call it reminiscentia, as it were a re-conning of our former actions.

'Sometimes a man knows a place determinate, within the compass of which he is to seek; and then his thoughts run over all the parts thereof, in the same manner as one would sweep a room to find a jewel; or as a spaniel ranges the field till he find a scent; or as a man should run over the alphabet to start a rhyme [or find the name of a person, a place, a thing].

'Sometimes a man desires to know the event of an action; and then he thinketh of some like action past, and the events thereof, one after another; supposing like events will follow like actions. As he that foresees what will become of a criminal, re-cons what he has seen follow on the like crime before; having this order of thought, the crime, the officer, the prison, the judge, and the gallows. Which kind of thought is called foresight, and prudence, or providence; and sometimes wisdom; though such conjecture, through the difficulty of observing all circumstances, is very fallacious. But this is certain, by how much one man has more experience of things past than another, by so much also he is more prudent, and his expectations the seldomer fail him. The present only has a being in nature; things past have a being in the memory only; but things to come have no being at all; the future being but a fiction of the mind, applying the sequels of actions past to the actions which are present; which, with most certainty, is done by him that has most experience; but not with certainty enough. And though it be called prudence, when the event answereth our expectation, yet, in its own nature, it is but presumption. For the foresight of things to come, which is providence, belongs only to him by whose will they are to come. From him only, and supernaturally, proceeds prophecy. The best prophet, naturally, is the best guesser; and the best guesser, he that is most versed and studied in the matters he guesses; for he has most signs to guess by.'

We have quoted more than was absolutely to our purpose, the better to enable the reader to compare the thoughts, and manner of thought and expression, in Hobbes, with those of Brown and Hume.

'Though it be too obvious,' says Hume, 'to escape observation, that different ideas are connected together, I do not find that any philosopher has attempted to enumerate or class all the principles of association; a subject however that seems worthy of curiosity. To me there appear to be only three principles of connexion among ideas, viz. resemblance, contiguity in time or place, and cause or effect.

'That these principles serve to connect ideas will not, I believe, be much doubted. A picture naturally leads our thoughts to the original. The mention of one apartment naturally introduces an enquiry concerning the others. And if we think of a wound we can scarcely forbear reflecting on the pain which follows it. But that the enumeration is complete, and that there are no other principles of association except these, may be difficult to prove to the satisfaction of the reader, or even to a man's own satisfaction. All we can do, in such cases, is to run over several instances, and examine carefully the principle which bends the different thoughts to each other, never stopping till we render the principle as general as possible. The more instances we examine, and the more care we employ, the more assurance shall we acquire that the enumeration which we form from the whole is complete and entire.' — *Enquiry concerning Human Understanding*, Sect. III.

On this enumeration of Mr. Hume Dr. Brown justly remarks:—'Causation, so far from being opposed to contiguity, so as to form a separate

class, is, in truth, the most exquisite species of proximity in time, and in most cases of contiguity in place also, which could be adduced; because it is not a proximity depending on casual circumstances, and consequently liable to be broken, but one which depends solely on the mere existence of the two objects that are related to each other as cause and effect, and therefore fixed and never-failing. On his own principles, therefore, the three connexions of our ideas should indisputably be reduced to two. To speak of resemblance, contiguity, and causation, as three distinct classes, is, with Mr. Hume's view of causation, and indeed with every view of it, as if a mathematician should divide lines into straight, curved, and circular.

But are these truly distinct classes of suggestion that are not reducible to any more common principles? or are they not all reducible to a single influence? All suggestions may, by minute analysis, be found to depend on prior co-existence.

For this reduction, however, we must take in the influence of emotions, and other feelings, very different from ideas; as when an analogous object suggests an analogous object by the influence of an emotion or sentiment, which each separately may have produced before, and which is therefore common to both. But, though a minute analysis may bring all our suggestions to one common influence of former proximity or co-existence of feelings, it is very convenient in illustration of the principle to avail ourselves of the most striking subdivisions, in which the particular instances of that proximity may be arranged; and, by substituting contrast for the superfluous subdivision of causation, the enumeration will stand thus:—1. Resemblance, including every species of analogy. 2. Contrast. 3. Contiguity.

The obvious instances of the effect of strong similarity in recalling objects are innumerable. Those which produce impressions on the organs of sense, and through them directly on the mind, do not require any indication. There is another species of resemblance founded on more shadowy analogies which gives rise to an innumerable series of suggestions. To these we owe the simile, the metaphor, and figurative language in general. In poetry we perceive every where what Akenside calls

> The charm
> That searchless nature o'er the sense of man
> Diffuses—to behold, in lifeless things,
> The inexpressive semblance of himself,
> Of thought and passion.

The zephyrs laugh—the sky smiles—the forest frowns—the storm and the surge contend together—the solitary place not merely blossoms like the rose, but is glad: all nature becomes animated. It is the metaphor which forms the essence of the language of poetry; and it is to a peculiar mode of the associating principle that the metaphor owes its birth, whether the analogy be derived from the moral to the physical, or from the physical to the moral world. The metaphor expresses with rapidity the analogy as it rises in immediate suggestion, and identifies it with the object of emotion which it describes; the simile presents, not the analogy merely, but the two analogous objects, and traces their resemblance with the formality of regular comparison. The metaphor is the figure of passion; the simile is the figure of calm description.

There is another set of resemblances, not in the objects themselves but in the mere verbal signs which indicate them, which have a powerful though less obvious influence on suggestion, and, without appearing to have any agency, often guide the trains of our thought and emotion. Our thoughts, which usually govern our language, are themselves, in a great measure, governed by that very language over which they seem to exercise unlimited sway; so true, in more respects than one, is the memorable and often quoted observation of Bacon, 'Credunt homines rationem suam verbis imperare, sed fit etiam ut verba vim suam super rationem retorqueant.' We do not speak at present of the influence which was particularly contemplated by the remark of that great master of wisdom in detecting the sources of error and prejudice; but of the influence which language indirectly acquires as a series of sounds, suggesting each other by their own similarity. Similar sounds suggest, by their mere similarity, similar sounds; and the words thus suggested awaken the conceptions which they are accustomed to express, and consequently the whole train of thoughts and images associated with these conceptions, which would not have arisen but for the accidental resemblance of one symbol to another.

Hence the influence of puns, rhymes, alliteration, &c. It is only where the direct verbal suggestion is rendered more apparent by the strange incongruity of the images, which the similar sounds chance to denote, as in the case of puns, that we usually ascribe the suggestion to the word and not to the thought itself. Even in the case of puns, it is only to the few in which the contrast of meaning is very striking that we pay any attention. How many words of similar sound arise in the mind, by this species of suggestion, which are never uttered as puns but pass silently away, because they are felt to be without that lucky ambiguity or opposition of meaning which alone could reconcile the hearers to this petty species of wit, or feed the vanity of the weakest mind so as to make it glory in so contemptible a kind of success and triumph? Next to this petty species of wit, as a proof of the influence of mere verbal similarities of sound in suggestion, the connecting influence of rhyme is obvious. That in rhyme sound suggests sound, and consequently operates indirectly on the train of thought by the mere symbolic resemblance, there can be no question, since it is nothing but the recurrence of similar sounds at regular or irregular intervals; and to these recurring sounds the train of thought must be, in a considerable degree, subservient, however great its independence may seem. Butler wittily compares rhyme to the rudder, which, though in the rear of the vessel, and apparently following its direction, directs the track which the whole vessel itself is to pursue. An influence on the succession or direction of thought, similar to that of the concluding syllables of verse, is exercised by the initial sounds

of words in alliteration. How readily suggestions of this kind occur, so as to modify indirectly the train of images and feelings in the mind, and what pleasure they afford when they seem to have arisen without effort, is marked by the tendency to alliteration which is so prevalent, not in the poetry merely, but still more in the traditionary proverbs of every country; as also in the alliterative designation of the heroes of romance. It is in verse, however, that the charm of alliteration is most powerfully felt. The following are obvious examples.

> Fill but his purse our poet's work is done,
> Alike to him by pathos or by pun.

> Or her whose life the church and scandal share
> For ever in a passion or a prayer.

The alliteration of words that express opposite ideas is a species of wit, as far as the pleasure of wit consists in the sudden discovery of unexpected resemblances, and approaches very nearly the nature of a pun, combined at the same time with the ludicrous antithesis which the objects themselves would have produced even without alliteration. Whether the resemblance be in the whole word, as in the pun, or only in part of the word, as in alliteration, the suggestion may be considered a decisive proof of the influence which is exercised over our trains of thought by the mere accident of the agreement of arbitrary sounds.

The force of contrast, as a suggesting principle, is next to be considered. Of this influence the instances are innumerable. The palace and the cottage—the cradle and the grave—the extremes of indigence and of luxurious splendor are not connected in artificial antithesis only, but arise in ready succession to the observing or reflecting mind without even the intervention of words, or any intention of producing effect upon any other mind. The mind of its own spontaneous accord is often not only busy comparing, but contrasting the objects of its perception. It is this tendency of the mind to pass readily from opposites to opposites, which renders the antithesis natural. When skilfully and sparingly used, it is unquestionably a figure of great power, from the impression of astonishment which the rapid succession of contrasted objects must always produce. This very facility, however, of producing astonishment at little cost of real eloquence, renders the antithesis the most dangerous and seductive of all the dangerous and seductive figures to a young orator.

We proceed to the consideration of nearness in time or place, the next general circumstance which has been specified as modifying suggestion. Of all the general principles of connexion in the mental trains, this is evidently the most frequent and extensive in its operation. Contiguity, or obvious nearness, in time or place, forms the whole calendar of the great multitude of mankind, who pay little attention to the arbitrary eras of chronology, but date events by each other, and speak of what happened in the time, or before, or after, some persecution, or rebellion, or great war, or frost, or famine. It is the same with nearness in place. To think of one part of a familiar landscape is to recal the whole. The hill, the grove, the church, the river, the bridge, and all the walks which lead to them, rise before the mind in immediate succession. From neighbouring place to place the thoughts wander readily with a sort of untaught geography; and but for this connecting principle, not even the labor of the longest life could have fixed in our mind the simple knowledge of that intuitive science.

It may be proper to enquire into the circumstances which modify the suggesting principle, or what may be termed its primary laws (in conformity to custom, though the expression is somewhat objectionable, being calculated rather to obscure and mislead than to enlighten and guide the understanding), resemblance, contrast, and contiguity. What are the modifying circumstances which (though not very happily) may be termed secondary laws? They seem evidently the following:—

1. That which induces one associate conception rather than another, is the length of time during which the original feelings (from which the associated conception arose) co-existed with, or succeeded each other. Objects slightly observed make no deep and lasting impression or permanent associations in the mind. The longer we dwell on objects the more fully do we rely on our future remembrance, which is a particular determination or exercise of mental suggestion. This is so obvious, indeed, as to be in a manner truistical.

2. The parts of a train appear to be more closely and firmly associated as the original feelings have been more lively. We remember brilliant objects more than those which are faint or obscure. Occasions of great joy or sorrow, pleasure or pain, rapture or perturbation, are seldom wholly forgotten; slight pleasures and pains, &c., which occur every hour, pass away like time itself, never to return. That strong feeling of interest and curiosity which we call attention, not only fixes the mind in longer contemplation of certain objects, but gives them more of vividness to our perception. Emotion then has powerful influence on the mental suggestion; and the more powerful the emotion, the more of a particular determination is given to the suggesting principle.

3. The parts of any train are more readily suggested in proportion as they have been more frequently renewed. Thus we remember verses after three or four readings which we could not have remembered after one reading. This also is so obvious as to be almost truistical.

4. Feelings are connected more strongly in proportion as they are more or less recent. Immediately after reading any single line of poetry we are able to repeat it, though we may have given it no particular attention; in a few minutes or hours after, we are no longer able to repeat it accurately. There is a striking exception to this in the case of old age; for events of youth are remembered when those of the year or perhaps week preceding are forgotten. Yet even in the case of extreme old age the same holds when the time is not so far back; and events which happened a few hours before are remembered, when those of as many days of priority are forgotten.

5. Successive feelings are associated more closely and permanently in proportion as they have co-existed more exclusively, or in a state of greater separation from other feelings. The song which we have never heard but from one person, or in one place, or in a particular state of mind, can scarcely be heard again by us without recalling that with which it was solely, so to speak, identified; but there is obviously much less chance of any such particular suggestion if we have heard the same air and words frequently sung by different persons, in different places, or in great variety of mental states as to cheerfulness or sadness, joy or grief, pleasure or pain.

6. The influence of the suggesting principle or tendency in consequence of (what may in compliance with custom be called the primary laws of suggestion) resemblance, contrast, and contiguity, is greatly modified by original constitutional differences, whether these are to be referred to the mind itself, or to varieties of bodily temperament. Such constitutional differences affect the suggesting tendencies in two ways; first by augmenting and extending the influence of all of them, as in the varieties of the general power of remembering so observable in different individuals; secondly they modify that influence by giving greater proportional vigor to one set of tendencies than to another. It is in this modification of the suggesting principle, and the peculiar suggestions to which it gives rise, that the chief part or rather the whole of what is properly termed genius seems to consist. We have seen that the primary tendencies of suggestion are of various species, some for example arising from mere analogy, others from direct contiguity, or nearness in time or place of the very objects themselves: and it is this difference of the prevailing tendency, as to these two species of suggestion, which appears to constitute all that is inventive in genius; invention consisting in the suggestions of analogy, as opposed to the suggestions of grosser contiguity.

This is by far the most interesting statement of all in reference to suggestion; but we have not been able to master and manage it to our satisfaction so as to free it from all obscurity and embarrassment, or to render it concise, simple, clear, and definite. What Dr. Brown means by saying 'constitutional differences affect the primary laws, first by augmenting and extending the influence of all of them, as in the varieties of the general power of remembering, so observable in different individuals,'—or how if it be intelligible, and understood as we suppose it must be understood, it can be consistent with other parts of his statements, we are at a loss to divine. We think by leaving the clause out altogether, the whole of the other part would be correct. What he says concerning genius is so admirable (for it is almost the only thing at all like a successful attempt of the kind), that we must give it at some length.

In the mind of one poet, for example, the conception of his subject awakens only such images as he had previously seen combined with it in the works of others; and he is thus fated, by his narrow and unvarying range of suggestion, only to add another name to the eternal list of imitators. In a poetic mind of a higher order the conception of this very subject cannot exist for a moment without awakening, by the different tendency of the suggesting principle, groups of images which never before had existed in similar combination; and, instead of being an imitator, he becomes a great model for the imitation of others. The prevailing suggestions of the one, in his trains of thought, are according to the relation of analogy, which is almost infinite; the prevailing suggestions of the other are those of contiguity of the images themselves, which, by its very nature, admits of no novelty, and gives only transcripts of the parts. To tame down original genius, therefore, to mere imitation, and to raise the imitator to some rank of genius, it would be necessary only to reverse these simple tendencies. The fancy of the one would then, in the suggestions of mere contiguity, lose all that variety which had distinguished it, and would present only such combinations of images as had before occurred to it in similar order, in the works of former writers; the fancy of the other, on acquiring the peculiar tendency to suggestions of analogy, would become instantly creative, new forms of external beauty or of internal passion would crowd upon his mind, by their analogy to ideas and feelings previously existing, and this single change of the direction of the suggesting principle would be sufficient to produce all those wonders which the poet of imagination ascribes to the influence of inspiring genii,

> Who conduct the wandering footsteps of the youthful bard,
> New to their springs and shades; who touch his ear
> With finer sounds; who heighten to his eye
> The bloom of nature; and before him turn
> The gayest, happiest attitudes of things.

The inventions of poetic genius, then, are the suggestions of analogy: the prevailing suggestions of common minds are those of mere contiguity; and it is this difference of the occasions of suggestions, not of the images suggested, which forms the distinctive superiority of original genius. Copious reading and a retentive memory may give to an individual, of very humble talent, a greater profusion of splendid images than existed in any one of the individual minds, on whose sublime conceptions he has dwelt till they have become, in one sense of the word, his own. There is scarcely an object which he perceives that may not now bring instantly before him the brightest imagery; but, for this suggestion, however instant and copious, previous co-existence or succession of the images was necessary; and it is his memory, therefore, which we praise. If half the conceptions which are stored in his mind, and which rise in it now in its trains of thought by simple suggestion, as readily as they arose in like manner in accordance with some train of thought in the mind of their original authors, had but risen by the suggestion of analogy, as they now arise by the suggestion of former proximity, what we call memory, which is, in truth, only the same suggestion in different circumstances, would have been fancy or genius; and his country and age would

have another name to transmit to the reverence and the emulation of the ages that are to follow.

It is the same with inventive genius in the sciences and the severer arts; which does not depend on the mere knowledge of all the phenomena previously observed, or of all the applications of them that have been made to purposes of art, but chiefly on the peculiar tendency of the mind to suggest certain analogous ideas in successions, different from those ordinary successions of grosser contiguity which occur to common minds. He may, perhaps, be called a philosopher, who knows accurately what others know, and produces with the same means which others employ the same effects which they produce. But he alone has philosophic genius, to whose speculations analogous effects proceed from analogous causes, and who contrives practically by the suggestion of analogy to produce new effects, or to produce the same effects by new and simpler means.

7. Differences of temporary emotion also (as well as constitutional differences) influence the suggesting principle. The same man is not the same in this respect at all periods of life, in all circumstances, or at all hours. As there are persons whose general character is gloomy or cheerful, we have in like manner our peculiar days or moments in which we pass from one of these characters to the other, and in which our trains of thought are tinctured with the corresponding varieties. A mere change of fortune is often sufficient to alter the whole cast of sentiment. Persons in possession of public station, and power, and affluence, are accustomed to represent affairs in a favorable light; the disappointed competitors for these to represent all in the most gloomy light. Much of this, at least, is fairly ascribable to the difference of coloring, in which objects appear to the successful and the unsuccessful.

8. The temporary diversities of state that give rise to varieties of suggestion are not mental only but corporeal. The extreme cases of intoxication or actual delirium need not be referred to for the copious flow of follies which a little wine or a few grains of opium may cause to proceed from the proudest reasoner. In circumstances less striking, how different are the trains of thought in health and sickness, after a temperate meal and after a luxurious excess! It is not to the animal powers only that the burthen of digestion may become oppressive, but to the intellectual also; and often to the intellectual powers or functions more than to the animal.

9. Habit also has much influence in modifying the suggesting principle. When men of different mental habits, or of different professions, observe the same circumstances, listen to the same story, or peruse the same book, their subsequent suggestions are far from being the same; and could the future differences of the associate feelings that are to rise be foreseen by us at the time, we should probably be able to trace many of them to former professional peculiarities, which are thus unfortunately apt to be more and more aggravated by the very suggestions to which they have themselves given rise.

The interesting nature and probable availableness of much of the above have induced us to transcribe from Dr. Brown's lectures at considerable length; and it happened to be such as to require little modification for our purpose. On what he entitles 'The degree of liveliness of the suggesting feelings influences greatly that of the feelings suggested, and the virtual co-existence of feelings;' there is, like the title of the discussion itself, a good deal that approaches to mysticism, and not a little of over-refinement. There is no doubt something of momentary illusion in such instances as he has adduced (and he might have given that of Dr. Johnson on one of his last visits to his native place getting up on the bough of a tree, and swinging as if he had been actually mad); but whether they are to be satisfactorily accounted for in the manner attempted, may leave some doubt. The anecdotes quoted from the late Dr. Rush of Philadelphia are striking, and the first of them may perhaps be turned to good account by persons who may be placed in similar circumstances with the narrator.

'During the time,' says Dr. Rush, 'I passed at a country school in Cecil county in Maryland, I often went on a holiday, with my schoolmates, to see an eagle's nest upon the summit of a dead tree in the neighbourhood of the school, during the time of the incubation of that bird. The daughter of the farmer in whose field this tree stood, and with whom I became acquainted, married, and settled in this city about forty years ago. In our occasional interviews, we now and then spoke of the innocent haunts and rural pleasures of our youth, and among other things of the eagle's nest in her father's field. A few years ago I was called to visit this woman when she was in the lowest stage of a typhus fever. Upon entering her room I caught her eye, and with a cheerful tone of voice, said only, The eagle's nest. She seized my hand without being able to speak, and discovered strong emotions of pleasure in her countenance, probably from a sudden association of all her early domestic connexions and enjoyments with the words I had uttered. From that time she began to recover. She is now living, and seldom fails, when we meet, to salute me with the echo of the eagle's nest.'

An anecdote like this in the midst of a metaphysical discussion will be regarded by the general reader as a rose in the desert, or a lily among thorns. The old African is a lively instance of the principle and power of association or suggestion.

'An old native African obtained permission from his master, some years ago, to leave home, in order to see a lion that was conducted as a show through the state of New Jersey. The moment he saw him, in spite of the torpid habits of mind and body contracted by fifty years' slavery, he was transported with joy, which he vented by jumping, dancing, and loud acclamations. He had been familiar with that animal, when a boy, in his native country; and the sight of him suddenly poured upon his mind the recollection of all his enjoyments, from liberty and domestic endearments, in his own country, in the early part of his life.' No doubt the

thoughts and feelings of the old African on this occasion were as different from what ours would be in viewing a lion as if the object itself were wholly different.

On 'the reduction of certain supposed faculties to simple suggestion,' we consider Dr. Brown as very successful. We shall as briefly as possible give the more remarkable observations.

The supposed intellectual power of conception, as distinct from association or suggestion, is founded on mistake respecting the nature of the latter. The power of conception and the power of association or suggestion are the same, both being only that particular susceptibility of the mind from which in certain circumstances conceptions arise: or, if the power of conception differ from the more general power of association, it is only as a part differs from the whole; as the power of taking a single step differs from the power of traversing a whole field; the power of drawing a single breath from the general power of respiration.

Memory is also resolvable into suggestion. Our remembrances are nothing more than conceptions united with a certain relation of time. They are conceptions of the past, felt as conceptions of the past; that is, felt as having a certain relation of antecedence to our present feelings. The remembrance is not a simple but a complex state of mind; and all which is necessary to reduce a remembrance to a mere conception is to separate from it a part of the complexity; that part of it which constitutes the notion of a certain relation of antecedence. We are conscious of our present feeling whatever it may be; for this is in truth only another name for our consciousness itself. The moment of the present time, at which we are thus conscious, is a bright point, ever moving, and yet as it were ever fixed, which divides the darkness of the future from the twilight of the past. The present moment then is a point which guides us in the most important of our measurements, in our retrospects of the past and our hopes of the future. The particular feeling of any moment before the present, as it rises again in our mind, would be a simple conception, if we did not think of it either immediately or indirectly in relation to some other feeling earlier or later. It becomes a remembrance when we combine with it this feeling of relation; the relation which constitutes our notion of time; for time as far as we are capable of understanding it, or rather of feeling it, is nothing more than the varieties of this felt relation, which in reference to one of the subjects of the relation we distinguish by the word before, in reference to the other by the word after. It is a relation which we feel nearly in the same manner as we feel the relation which bodies have to each other as co-existing in space. There is some point to which, in estimating distance of space, we refer the objects which we measure, as there is a point of time in the present moment, or in some event which we have before learned to consider thus relatively, to which directly or indirectly we refer the events of which we speak as past or future, or more or less recent. We are capable of considering a variety of events, all of which are felt by us to bear to that state of mind which constitutes our presen consciousness, some relation of priority or subsequence, which they seem to us to bear reciprocally to each other; and the variety of this relation obliges us to invent a general name for expressing them all. This general word invented by us for expressing all the varieties of priority and subsequence is time, a word, therefore, which expresses no actual reality, but only relations that are felt by us in the objects of our conception. To think of time is not to think of any thing existing of itself, for time is not a thing but a relation; it is only to have some conceptions of objects which we regard as prior and subsequent; and without the conception of objects of some kind, as subjects of the relation of priority and subsequence, it is as little possible for us to imagine any time, as brightness or dimness without a single ray of light, proportional magnitude without any dimensions, or any other relation without any other subject. When the notion of time, then, is combined with any of our conceptions, as in memory, that which is combined with the simple conception is the feeling of a certain relation. To be capable of remembering, in short, we must have a capacity of the feelings which we term relations, and a capacity of the feelings which we term conceptions, that may be the subjects of the relations; but with these two powers no other is requisite, no power of memory distinct from the conception and relation which that complex term denotes.

How different is this from the jargon of the schools with which we have been so long persecuted concerning time, duration, memory, and such everlasting topics for mysticism and folly to practise their philosophy upon! Dr. Brown seems to have here, as elsewhere indeed in the same way, to have fallen into a slight error from not studying the nature of words more. Time is not a general word invented by us for expressing all the varieties of priority and subsequence. We never invented it at all for any purpose whatever; though false philosophy among us as well as among others has tried to make it into something it never was and never could be: and we might as well say that terminus, of which we doubt not it is a corruption, or our word term, or dies, or period, or era, or epoch, or any word connected with our measuring as to priority and subsequence is a general word invented by us for such a purpose as that time is such an invention. We cannot but wonder too that Dr. Brown should seem to reverence such venerable absurdity as the remark of St. Austin upon the subject. If it be 'one of those subjects which grow more obscure beneath our very gaze,' why gaze at all? It was surely quite sufficient that Mr. Dugald Stewart had commented very fully on the noted text of St. Austin.

With much other false theory or idle guesses about memory, put forth with a philosophic air of importance, it has been said that there is a species of it which is under our control, or that in some respects this faculty or power is subject to our volition as much as muscular motion. On this Dr. Brown justly remarks that this is nothing but memory combined with desire, and

which is commonly called recollection; that to will any idea necessarily implies that we know what we will; and implies the absurdity in the supposed volition acting on memory of knowing and not knowing the same thing at the same moment of time; or of desiring to become possessed of what we have in our possession already. What is termed voluntary recollection, whether direct or indirect, is nothing more than the co-existence of some vague and indistinct desire with our simple trains of suggestion.

In estimating the power of memory, in all its striking diversities in different individuals, it is necessary to guard against some prevailing errors. A good memory has fallen into a sort of proverbial disrepute, as unfriendly to judgment, or indicative of a defect in the nobler qualities of intellect. On this subject we have a very striking illustration in some theories of lord Kames, of the correctness of the remark we have quoted from Mr. Playfair. Men think they are reasoning from fact and experience, when in reality they are only reasoning from a mixture of truth and falsehood. The only end answered by facts, so incorrectly apprehended, is that of making error more incorrigible. 'In the minds of some persons,' says lord Kames, 'thoughts and circumstances crowd upon each other by the slightest connexions. I ascribe this to a bluntness in the discerning faculty; for a person who cannot accurately distinguish between a slight connexion and one that is more intimate is equally affected by each: such a person must necessarily have a great flow of ideas, because they are introduced by any relation indifferently; and the slighter relations, being without number, furnish ideas without end. On the other hand, a man of accurate judgment cannot have a great flow of ideas; because the slighter relations, making no figure in his mind, have no power to introduce ideas. And hence it is that accurate judgment is not friendly to declamation or copious eloquence. This reasoning is confirmed by experience; for it is a noted observation, that a great or comprehensive memory is seldom connected with a good judgment.'

In all this confirmation of experience there is a mixture of truth, but there is as great a mixture of error. It would seem, according to this philosopher, that a bad memory is an indispensable requisite to a good judgment; a very comfortable doctrine to idle boys and to old philosophers, who have almost all complained or boasted of a bad memory.

It is not a good memory in its best sense, as a rich and retentive store of conceptions, that is unfriendly to intellectual excellence, but a memory of which the predominant tendency is to suggest objects and images which existed before, exactly as they did previously exist, according to the mere relations of contiguity. The richer the memory, the more copious will be the suggestions of analogy which constitute invention. It is the quality of memory as suggesting objects in their old and familiar sequences of contiguity, not the quantity of the store of suggestions, that is unfriendly to genius; though this very difference of quality may, to superficial observers, seem like a difference of the quantity of the actual power. It is not from any defect of memory that fewer of the ideas which prevail in common conversation arise to a mind of accurate judgment; but because such a mind does not feel the same interest in them, or assign the same importance to them as the voluble Mrs. Quickly: in such a mind the prevailing tendencies of suggestion are of a species that have little relation to mere dates, and the trivial occurrences which are the ordinary topics of familiar discourse.

In extemporary eloquence the flow of mere words may and will be more copious in him who is not accustomed to dwell on the permanent relations of objects, but on the slighter circumstances of perception and local connexion; and he will doubtless be the most ready and voluble and effective orator, ad captandum vulgus. This only proves that he has a different kind, not a richer memory, when compared with a more profound and more accurate reasoner; the whole series of whose suggestions is greater in real amount than the number of those which rise so promptly to the mind of a superficial thinker. The great difference is, as so often remarked, the wealth of the one consists in plenty of small but ready money; that of the other is more rare and massy, and rather deposited than carried about for current use, or to be exhibited to the vulgar gaze.

The next part of the mental phenomena (for, as the term has been introduced, it is somewhat convenient at times) is imagination, usually made to figure as a very prominent, distinct, faculty, power, or entity of the mind. We not merely perceive objects, and conceive or remember them simply as they were before, but we have the power of combining them in various new assemblages into a new and varied universe, with every succession of our thought. The materials of which we form them exist in every mind, but they exist there only as the stones in the quarry, that require little more than mechanic labor to convert them into common dwellings, but which rise into palaces and temples at the command of architectural genius.

Our limits will not permit us to attempt an abridgment of Dr. Brown's interesting discussion, in resolving imagination into suggestion. His analytic process, we think, not only ingenious and minute, but perfectly successful and satisfactory. He has effectually dispelled much false theory—he has thrown down the cumbrous complexity of his metaphysical predecessors in Scotland. But we can make room for only a few specimens.

Imagination has been generally regarded as implying a voluntary selection and combination of images, for the production of compounds different from those which nature exhibits. This opinion is certainly false, in part at least. We have seen, in considering some other mental processes, that they assume a very different appearance when united with desire. Thus mere perception when united with desire becomes attention,—memory becomes recollection. A similar difference is produced by the union of desire with that spontaneous suggestion of

images called imagination, which may be considered therefore as existing without desire, or as existing in combination with desire or intention.

This distinction is so obvious that every person who is at all in the practice of looking inwards, or of consulting his consciousness, must be aware of it; and must have as firm a belief of it as of his identity: it is explicitly and fully stated within the compass of the few sentences quoted from Hobbes in a preceding part. That there is imagination, says Dr. Brown, or new combinations of images and feelings unaccompanied with any desire, and consequently altogether void of selection, is as true as that there is memory without intentional reminiscence, or recollection of the trains of our thought. Our conceptions often rise simply as they have existed before; they rise often mixed in various forms and proportions, as they never have existed before; and in both cases equally without any desire on our part. We as little will the various scenery of our reveries, and all the strange forms which seem to people them, as we will our dreams, or as we will the intrusion of unpleasant thoughts, remembrances, or anticipations, which we are intensely desirous of banishing from our minds, or as we will the conception of any one with whom we are acquainted, when the image of him instantly arises merely on reading his name, or seeing his portrait.

The momentary groups of images that arise independently of any desire, design, or choice on our part, and arise in almost every minute to almost every mind, constitute by far the greater number of our imaginations; and, to suppose predetermining selection necessary to every new complex conception, would therefore be almost to annihilate imagination itself. Such then is imagination, considered, as it most frequently occurs, without any concomitant desire—a mode of the general capacity of simple suggestion, and nothing more. But there are, unquestionably, cases in which desire, design, or intention of some sort, accompanies it during the whole or the chief part of the process; and it is of these cases chiefly that we are accustomed to think, in speaking of this supposed power or faculty. Such is the frame of the mind, in composition of every species, in prose or verse. In this state, conceptions follow each other, and new assemblages are formed. It is a continued exercise of imagination: what then is the analysis of our feelings in this state of voluntary thought, when there is a desire of forming new groups of images, and new groups of images arise?

To sit down to compose is to have a general notion of some subject which we are about to treat, with the desire of developing it, and the expectation, or perhaps the confidence, that we shall be able to develope it more or less fully. The desire, like every other vivid feeling, has a degree of permanence which only our vivid feelings possess; and, by its permanence, tends to keep the accompanying conception of the subject, which is the object of the desire, also permanent before us; and, while it is thus permanent, the usual spontaneous suggestions take place—conception following conception in rapid but relative series, and our judgment, all the time, approving and rejecting, according to those relations of fitness and unfitness to the subject which it perceives in the parts of the train. Such seems to be a faithful picture of the state or successive states of the mind, in the process of composition. It is not the exercise of a single power, but the development of various susceptibilities, of desire, of simple suggestion, by which conceptions rise after conception,—of judgment, or relative suggestion (presently to be treated of) by which a feeling of relative fitness or unfitness arises, on the contemplation of the conceptions that have thus spontaneously presented themselves. We think of some subject; the thought of this subject induces various conceptions related to it. We approve of some, as having a relation of fitness for our end, and disapprove of others as unfit. We may term this complex state, or series of states, imagination, or fancy, and the term may be convenient for its brevity. But, in using it, we must not forget that the term, however brief and simple, is still the name of a state that is complex, or of a succession of certain states; that the phenomena comprehended under it, being the same in nature, are not rendered, by this use of a mere word, different from those to which we have already given peculiar names, expressive of them as they exist separately; and that it is to the classes of these elementary phenomena, therefore, that we must refer the whole process of imagination in our philosophic analysis, unless we exclude analysis altogether, and fill our mental vocabulary with as many names of powers as there are complex affections of the mind. According to our analysis, then, there is no operation of any distinct power, or faculty (called imagination), but merely the rise of various images according to the ordinary laws of simple suggestion, in coexistence with feelings that arise from some other common principles of the mind, particularly desire, and the feeling of relation.

Through the whole of this discussion the lecturer must have been in a most enviable state of mind, and he appears to more than usual advantage as an intellectual anatomist or analyst, whichever image of him we may choose to adopt. The mastery of his metaphysical genius is such as to seem to twirl or play with the most difficult part of his subject, as if enjoying an intellectual amusement, rather than engaged in a gymnastic contest.

A lecture is devoted to the reduction of habit into suggestion, and refutes with abundant ease the notion of Dr. Reid, who, of course, ascribes the effects of habit to a peculiar ultimate principle, faculty, power, or potentate of the mind; and Hartley's famous vibratiuncle theory. Perhaps Dr. Brown might have been better employed than in disturbing its last moments: it might have been suffered to expire in peace, and die a natural death. One paragraph concerning habit is all that our limits will permit us to transcribe.

To explain the influence of habit, in increasing the tendency to certain actions, it must be remarked, that the suggesting influence, which is usually expressed in the phrase association of ideas (though that very improper phrase

would seem to limit it to our ideas or conceptions only, and has unquestionably produced a mistaken belief of this partial operation of the general influence) is not limited to these more than to any other states of the mind, but occurs also with force in other feelings, which are not commonly termed ideas or conceptions; that our desires, or other emotions, for example, may, like them, form part of our trains of suggestion; and that it is not more wonderful, therefore, that the states of the mind which constitute certain desires, after frequently succeeding certain perceptions, should, on the mere renewal of the perceptions, recur once more, than that any one conception should follow in this manner any other conception,—that the mere picture of a rose, for example, should suggest its fragrance; or that verses, which we have frequently read, should rise once more successively in our memory, when the line which precedes them has been repeated to us, or remembered by us. To him who has long yielded servilely to the practice of intoxication, the mere sight or the mere conception of the poisonous beverage to which he has sacrificed his health, and virtue, and happiness, will induce almost as if mechanically the series of mental affections on which the worse than animal appetite, and the muscular motions necessary for gratifying it, depend. Perhaps, at the early period of the growth of the passion, there was little love of the wine itself, the desire of which was rather a consequence of the pleasure of gay conversation that accompanied the too frequent draught. But, whatever different pleasures may originally have accompanied it, the perception of the wine, and the draught itself, were frequent parts of the complex process; and, therefore, those particular mental states which constituted the repeated volitions necessary for the particular muscular movements; and it is not wonderful, therefore, that all the parts of the process should be revived by the mere revival of a single part. What is called the power of habit is thus suggestion, and nothing more. The sight of the wine before him has co-existed innumerable times with the desire of drinking it. The state of mind, therefore, which constitutes the perception, induces, by the common influence of suggestion, that other state of mind which constitutes the desire, and the desire all those other states or motions which have been its usual attendants.

In the lecture (XLIV.) on The Influence of Particular Suggestions on the Intellectual and Moral Character, are many very important remarks; but they are not strictly metaphysical, and we can only quote a few of them.

Much of what is commonly called genius or of the secondary direction of genius which marks its varieties, and gives it a specific distinctive character, depends on accidents of the slightest kind that modify the general tendencies of suggestion, by the peculiar liveliness which they give to certain trains of thought. We are told in the Life of Chatterton, that, in his early boyhood, he was reckoned of very dull intellect, till he 'fell in love,' as his mother expressed it, with the illuminated capitals of an old musical manuscript in French, from which she taught him his letters; and a black-letter bible was the book from which she afterwards taught him to read. It is impossible to think of the subsequent history of this wonderful young man, without tracing a probable connexion of those accidental circumstances, which could not fail to give a peculiar turn to certain conceptions, with the character of that genius which was afterwards to make gray-headed erudition bend before it, and to astonish at least all those on whom it did not impose.

The illustrious French naturalist, Adanson, was in very early life distinguished by his proficiency in classical studies. In his first years at college he obtained the highest prizes in Greek and Latin poetry, on which occasion he was presented with the works of Pliny and Aristotle. The interest which such a circumstance could not fail to give to the works of these ancient enquirers into nature, led him to pay so much attention to the subjects of which they treated, that when he was scarcely thirteen years of age he wrote some valuable notes on the volumes that had been given to reward his studies of a different kind.

Vaucanion, the celebrated mechanician, who, in every thing which did not relate to his art, showed so much stupidity that it has been said of him, that he was as much a machine as any of the machines which he made,—happened, when a boy, to be long and frequently shut up in a room, in which there was nothing but a clock, which, therefore, as the only object of amusement, he occupied himself with examining, so as at last to discover the connexion and uses of its parts; and the construction of machines was afterwards his constant delight and occupation. The biography of many other eminent men might be referred to for multitudes of similar incidents, that appear to correspond, with an exactness more than accidental, with the striking peculiarities of character afterwards displayed by them.

Speaking of the prejudice for antiquity and established authorities in literature, we have the following just remark, which in our opinion applies to many of the admirers, or rather applauders, of Locke (for men can applaud in the dark) as fitly as if it had been made for them. How many are there who willingly join in expressing veneration for works which they would think it a heavy burden to read from beginning to end! Indeed this very circumstance, when the fame of an author has been well established, rather adds to his reputation than diminishes it; because the languor of a work of course cannot be felt by those who never take the trouble of perusing it, and its imperfections are not criticised, as they otherwise would be, because they must be remarked before they can be pointed out, while the more striking beauties, which have become traditionary in quotation, are continually presented to the mind. There is much truth, therefore, in the principle, whatever injustice there may be in the application of the sarcasm of Voltaire on the Italian poet, Dante, that 'his reputation will now continually be growing greater and greater, because there is now nobody who reads him.'

We proceed now to a most important part of Dr. Brown's discussions, On the Phenomena (we wish he could have done without this pompous term, which induces some confusion whereever it occurs) of Relative Suggestion. It is an arduous task to give the essential particulars of the extended whole in a small compass, as a map of a large country on a very reduced scale; but we shall do the best we can.

We have seen that there are many internal states or affections of the mind which arise simply in succession in the floating imagery of our thought, without involving any notion of the relation of the preceding objects or feelings to each other, and which have been classed under the head of simple suggestion. But there is an extensive order of our feelings which involve the notion of relation, and which consist, indeed, in the mere perception of a relation of some sort. To these feelings of mere relation, as arising directly from the previous states of mind which suggest them, we have given the name of relative suggestions—meaning by this term very nearly what is meant by the term comparison, when the will or intention which the word seems necessary to imply (but which is far from necessary to the suggestions of relation), is excluded; or what is meant at least in the more important relations by the term judgment—if not used (as it often is in vague popular language) to denote the understanding, or mental functions in general; and if not confined (as it usually is in books of logic), to the feeling of relation in a single proposition, but extended to all the feelings of relation, in the series of propositions which constitute reasoning; since these are, in truth, only a series of feelings of the same class as that which is involved in every simple proposition. Whether the relation be of two or of many external objects, or of two or of many affections of the mind, the feeling of this relation arising in consequence of certain preceding states of mind is what we term relative suggestion. That is the simplest phrase which we can employ for expressing without any theory the mere fact of the rise of certain feelings of relation after certain other feelings which precede them.

By an original tendency or susceptibility of the mind we are instantly sensible of the relation of objects in certain respects as really as we are sensible of their existence, or have that inward feeling which we call perception. As there are various species of sensation or perception, so there are various species of relations. Their number indeed, even of external things, is innumerable. The more numerous, however, these relations, the more necessary it is to have some arrangement.

All our relations (or relations felt by us) are either of external objects, or of our own internal affections or states of the mind, considered as merely co-existing without any reference to time, or considered as successive with reference to time. To take an example of each kind: we feel that the one half of four is to twelve as twelve to seventy-two; and we feel this kind of relation merely by considering the numbers together, without any regard to time. No notion of change or succession is involved in it. The relation was, and is, and will for ever be the same—as often as the numbers may be distinctly conceived and compared. On the other hand, we think of summer; we consider the warmth of the sky and the profusion of flowers. We think of the cold of winter, and of flowerless fields and frozen rivulets. The warmth and the cold of the different seasons we regard as the causes of the different appearances. In this case, as in the former, we feel a relation, but it is a relation of antecedence and consequence, to which the notion of time or change or succession is so essential, that without it the relation could not be felt.

Our first class of relations, then, are those of which the subjects are regarded without reference to time. To this order of real co-existence as in matter, or of seeming co-existence as in the complex states of the mind, belong the relation of position, resemblance or difference, proportion, degree, comprehension.

We look at a number of men as they stand together. If we merely perceived each individually, or the whole as one complex group, we should have no feeling of relation; but we remark one—we observe who is next to him, who second, and who third; who stands on the summit of a little eminence above all the rest; who in the plain below. This is the feeling of the relation of position; that is, our mind exists in those states which constitute this feeling in reference to the number of men contemplated or viewed standing together.

We see two flowers of the same tints and form. We lift our eyes to two cliffs of corresponding outline. We look at a picture, and think of the well-known face which it represents. We listen to a ballad, and seem almost to hear again some kindred melody which it wakes in our remembrance. In each of these cases, if the relative suggestion take place, our mind, after existing in the states which constitute the perception, or the remembrance of the two similar objects, exists immediately in that state which constitutes the feeling of resemblance, as it exists in the state which constitutes the feeling of difference, when we think of certain circumstances in which objects, though similar, perhaps, have in other respects no correspondence or similarity whatever. The above then is the feeling of a relation of resemblance or difference.

We think of the vertical angles formed by two straight lines, which cut one another; of the pairs of numbers, four and sixteen, five and twenty: of the dimensions of the columns and their bases and entablatures, in the different orders; and our mind exists immediately in that state which constitutes the feeling of proportion.

We hear one voice, and then a voice which is louder. We take up some flowers, and smell first one, and then another, more or less fragrant. We remember many days of happiness, spent with friends who are far distant; and we look forward to the day of still greater happiness, when we are to meet again. In these instances of spontaneous comparison our mind exists in that state which constitutes the feeling of degree.

We consider a house, and its different apart-

ments; a tree, and its branches, and stems, and foliage; a horse, and its limbs, and trunk, and head. Our mind, which had existed in the states which constituted the simple perception of these objects, begins immediately to exist in that different state which constitutes the feeling of the relation of parts to one comprehensive whole.

In these varieties of relative suggestion, some one of which, as you will find, is all that constitutes each individual judgment, even in the longest series of our ratiocination, nothing more is necessary to the suggestion or rise of the feeling of relation than the simple previous perceptions, or conceptions, between the objects of which the relation is felt to exist. When we look at two flowers it is not necessary that we should have formed any intentional comparison. But the similitude strikes us, before any desire of discovering resemblance can have arisen. We may, indeed, resolve to trace, as far as we are able, the resemblance of particular objects, and may study them accordingly; but this very desire presupposes, in the mind, a capacity of relative suggestion, of which it avails itself; in the same manner as the intention of climbing a hill, or traversing a meadow, implies the power of muscular motion, as a part of our physical constitution.

Besides a thousand other delights and benefits, it is to the results of resemblances that we owe all classification, and, consequently, almost all that is valuable in language. That classification is founded on the relation of similarity of some sort, in the objects classed together, and could not have been formed if the mind, in addition to its primary powers of external sense, had not possessed that secondary power, by which it invests with certain relations the objects which it perceives, is most evident. All which is strictly sensitive in the mind might have been the same as now; and the perception of a sheep might have succeeded a thousand times the perception of a horse without suggesting the notion which leads us to form the general term quadruped, or animal, inclusive of both. The relation is truly no part of the object perceived by us, and classed as relative and correllative, each of which would be precisely the same in every quality which it possesses, and in every feeling which it directly excites, though the others with which it may be classed had no existence. It is from the laws of the mind which considers them that the relation is derived; not from the laws or direct qualities of the objects considered. But for our susceptibilities of those affections, or states of the mind, which constitute the feeling of similarity, all objects would have been to us, in the scholastic sense of the phrase, things singular, and all language, consequently, nothing more than the expression of individual existence. Such a language, it is very evident, would be of little service in any respect, and of no aid to the memory, which it would oppress rather than relieve. It is the use of general terms; that is, of terms founded on the feeling of resemblance, which alone gives to language its power, enabling us to condense, in a single word, the innumerable objects which, if we attempted to grasp them all individually in our conception, we should be as little able to comprehend, as to gather all the masses of all the planets in the narrow concavity of that hand which a few particles are sufficient to fill, and which soon sinks oppressed with the weight of the few particles that fill it.

That man can reason without language of any kind, and consequently without general terms, though the opposite opinion is maintained by many very eminent philosophers (not by Hobbes however, who expresses in substance the same opinion as Dr. Brown), seems not to admit of any reasonable doubt: or, if it required any proof, it would seem to be sufficiently shown by the very invention of the language which involves these general terms; and still more sensibly by the conduct of the uninstructed deaf and dumb; to which, also, the evident marks of reasoning in the other animals,—of reasoning as unquestionable as the instincts that mingle with it, may be said to furnish a very striking additional argument from analogy. But it is not less certain that, without general terms, reasoning must be very imperfect, and scarcely worthy of the name, when compared with that noble power which language has rendered it. The art of definition, which is merely the art of fixing in a single word or phrase the particular circumstance of agreement of various individual objects, which, in consequence of this feeling of relation we have chosen to class together, gives us certain fixed points of reference, both for ourselves and others, without which it would be impossible for us to know the progress which we have made impossible to remember accurately the results even of a single reasoning, and to apply them, with profit, to future analysis. Nor would knowledge be vague only; it would, but for general terms, be as incommunicable as vague; for it must be remembered that such terms form almost the whole of the great medium, by which we communicate with each other.

The perception of objects, the feeling of their resemblance in certain respects, the invention of a name for these circumstances of felt resemblance: what can be more truly and readily conceivable than this process! And yet, on this process, apparently so very simple, has been founded all that controversy, as to universals, which so long distracted the schools; and which far more wonderfully (for the distraction of the schools by a few unintelligible words scarcely can be counted wonderful) continues still to perplex philosophers with difficulties which themselves have made, with difficulties which they could not even have made to themselves, if they had thought for a single moment of the nature of that feeling of the relation of similarity which we are now considering.

We feel, in transcribing the words of the lecturer, as if partaking in his triumph. This lecture alone, this portion of it which we have extracted, is worth all the contributions of discovery, and data, and phenomena, to the science of mind, we say not of Dr. Reid and his compeers and illustrious pupil, but of all the intellectual philosophers since the days of Hobbes, with Hartley and Hercules at their head. This alone would have proclaimed Dr. Brown worthy of moving up to the highest place of metaphy

sical dignity, and of taking his station at the right hand of the philosopher of Malmesbury. We regard the discussion of relative suggestion as one of the mightiest achievements and proudest triumphs of human reason. But we have neither time nor space to give vent to all our feelings, or to point out the grounds on which our admiration rests, or the claims of Dr. Brown not only to our applause, but to our gratitude as an intellectual benefactor of the highest order. Transcription is in itself, abstractedly considered, irksome, laborious work, and we would rather give the ideas of the lecturer in our own words were we not fearful of marring his reasoning. We must transcribe his recapitulation of the preceding lecture almost verbatim.

'Having brought to a conclusion my remarks concerning simple suggestion, I entered, in my last lecture, on the consideration of those states of mind which constitute our feelings of relation, the results of that peculiar mental tendency to which, as distinguished from the simple suggestion that furnishes the other class of our intellectual states of mind, I have given the name of relative suggestion. The relations which we are thus capable of feeling, as they rise by internal suggestion, on the mere perception or conception of two or more objects, I divided, in conformity with our primary division of the objects of physical enquiry, into the relations of co-existence, and the relations of succession, according as the notion of time or change is or is not involved in them; and the former of these, the relations that are considered by us without any regard to time, I arranged in subdivisions, according to the notions which they involve, 1. Of position; 2. Resemblance or difference; 3. Of degree; 4. Of proportion; 5. Of comprehensiveness, or the relation which a whole bears to the separate parts that are included in it.

'These various relations I briefly illustrated in the order in which I have now mentioned them, and showed how very simple that mental process is by which they arise; as simple, indeed, and as easily conceivable, as that by which the primary perceptions themselves arise. On some of them, however, I felt it necessary to dwell with fuller elucidation; not on account of any greater mystery in the suggestions on which they depend, but on account of that greater mystery which has been supposed to hang about them.

'A great part of my lecture, accordingly, was employed in considering the relation of resemblance, which, by the general notions and corresponding general terms that flow from it, we found to be the source of classification and definition, and of all that is valuable in language.

'A horse, an ox, a sheep, have, in themselves, as individual beings, precisely the same qualities, whether the other be or be not considered by us at the same time. When, in looking at them, we are struck with their resemblance in certain respects, they are themselves exactly the same individuals as before; the only change which has taken place being a feeling of our own mind. And, in like manner, in the next stage of the process of verbal generalisation, when, in consequence of this feeling of relation in our own minds, we proceed to term them quadrupeds or animals, no quality has been taken from the objects which we have ranged together under this new term, and as little has any new quality been given to them. Every thing in the objects is precisely the same as before, and acts in precisely the same manner on our senses, as when the word quadruped or animal was uninvented. The general terms are expressive of our own internal feelings of resemblance, and of nothing more; expressive of what is in us, and dependent wholly on laws of mind, not of what is in them, and directly dependent in any degree on laws of matter.

'That, in looking at a horse, an ox, a sheep, we should be struck with a feeling of their resemblance in certain respects; that to those respects in which they are felt to resemble each other we should give a name, as we give a name to each of them individually, comprehending under the general name such objects only as excite, when considered together with others, the feeling of this particular relation; all this has surely nothing very mysterious in it. It would, indeed, be more mysterious, if, perceiving the resemblance of objects that are constantly around us, we did not avail ourselves of language, as a mode of communicating to others our feeling of the resemblance, as we avail ourselves of it in the particular denomination of the individual, to inform others of that particular object of which we speak; and to express the common resemblance which we feel by any word, is to have invented already a general term, significant of the felt relation. The process is in itself sufficiently simple; and, if we had never heard of any controversies with respect to it, we probably could not have suspected, that the mere giving of a name to resemblances which all perceive, and the subsequent application of the name only where the resemblance is felt, should have been thought to have any thing in it more mysterious than the mere giving of a name to separate objects which all perceive, and the repetition of that name when the separate objects are again perceived. It assumes, however, immediately an air of mystery when we are told, that it relates to the predicables of the schools, and to all that long controversy with respect to the essence of universals, which divided not merely schoolman against schoolman, but nation against nation; when kings and emperors, who had so many other frivolous causes of warfare without the addition of this, were eager to take up arms, and besiege towns, and cover fields with wounded and dead, for the universal à parte rei. It is difficult for us to think that that could be simple which could produce so much fierce contention; and we strive to explain in our own mind, and, therefore, begin to see many wonderful, and perhaps unintelligible, or at least doubtful things, in phenomena which we never should have conceived to require explanation, if others had not labored to explain them, by clouding them with words.

'It is with many intellectual controversies as with the gymnastic exercises of the arena; the dust, which the conflict itself raises, soon darkens that air which was clear before; and the longer the conflict lasts the greater the dimness which arises from it. When the combatants are very

many, and the combat very long and active, we may still, indeed, be able to see the mimickry of fight, and distinguish the victors from the vanquished; but even then we scarcely see distinctly; and all which remains when the victory at last is won, or when both parties are sufficiently weary and choked with dust, is the cloud of sand which they have raised, and perhaps some traces of the spot where each has fallen.

'That the subject of generalisation should have appeared mysterious to the schoolmen is not very surprising. But I must confess that there is nothing in the history of our science which appears so wonderful as that any difficulty (at least any difficulty greater than every phenomenon of every kind involves) should now be conceived to attach to this very simple process; and especially that philosophers should be so nearly unanimous in an opinion on the subject, which though directly opposed to the prevalent error in the ancient schools is not the less itself an error.

In the view which is taken of the process of generalisation (as of every other process) there may be error in two ways; either by adding to the process what forms no part, or by omitting what does truly form a part of it. Thus, if we were to say, that, between the perception of a horse and sheep, and the feeling of their resemblance in a certain respect, there intervenes the presence of some external independent substance; some universal form or species of a quadruped, distinct from our conceiving mind, which acting on the mind, or being present with it, produces the notion of a quadruped, in the same way as the presence of the external horse or sheep produced the perception of these individually; we should err, in the former of these ways, by introducing into the process something of which we have no reason to suppose the existence, and which is not merely unnecessary, but would involve the process in innumerable perplexities and apparent inconsistencies, if it did exist. This redundance would be one species of error; but it would not less be an error (though an error of an opposite kind), were we to suppose that any part of the process does not take place; that, for example, there is no relative suggestion, no rise in the mind of an intervening general notion of resemblance, before the invention and employment of the general term, but the mere perception of a multitude of objects, in the first place; and then, as if in instant succession, without any other intervening mental state whatever, the general names under which whole multitudes are classed.

'I have instanced these errors of supposed excess and deficiency, in the statement of the process, without alluding to any sects which have maintained them. But the two opposite errors which I have supposed are the very errors involved in the opinions of the realists and nominalists; the great combatants in that most disputatious of controversies, to which I have before alluded; a controversy which in the strong language of John of Salisbury, even at that early period, of which alone he could speak, had already employed fruitlessly more time and thought than the whole race of the Cæsars had found necessary for acquiring and exercising the sovereignty of the world.

'Realism, which descended from Pythagoras, Plato, and Aristotle, as the orthodox inheritance in metaphysics of the schoolmen, is now universally admitted to be glaringly absurd: it has not been so hitherto, however, with Nominalism, which was espoused first by Roscelinus and after him by Abelard, Luther, Hobbes, Berkeley, Hume, Dr. Campbell, and almost every philosopher of any note. Mr. Locke and Dr. Reid may be said to have had respectively some intermediate dark or confused notion of their own. The noted abstract or general triangle of the former has long been a subject of merriment. One of the most prominent and plausible nominalists is Mr. Horne Tooke, who holding that there is nothing general but terms, and that it is as absurd to speak of a complex idea as to call a constellation a complex star, was to accomplish wonderful logical things by his wonder-working etymology. In confidence or pretension he was almost a match for Kant the critic of pure reason. But after running his etymological race after the Northern lights, as the only infallible guides in the conduct of the understanding, he left poor human reason in the same general darkness and error in which he found it as an object of his benevolent regard or tender compassion. He did something it is true by etymology for the better understanding of language as an instrument of reasoning and a medium of thought; and he would have done more but for his blind credulity and over-weening affection towards the northern origin.' We wish Dr. Brown had studied and understood the nature and office of language as much as he did, or rather as much as his great metaphysical predecessor and prototype in most other respects, the philosopher of Malmesbury. In that case what would he not have effected? But we are unwise or unreasonable perhaps in wishing that he had been any thing but precisely what he was. But we must again permit him to address the reader and dispose of nominalism.

'Even in professing to exclude the general notion of resemblance, the nominalist unconsciously proceeds on it; and no stronger proof can be imagined of the imperfectedness of the view which his system gives of our generalisations than the constant necessity under which we perceive him to labor of assuming, at every stage of his argument, the existence of those very notions, or feelings of relative suggestion against which his argument is directed. The general term, we are told, is significant of all objects of a certain kind, or a particular idea is made to represent various other ideas of the same sort; as if the very doctrine did not necessarily exclude all notion of a kind or sort, independent of the application of the term itself. 'An idea,' says Berkeley, 'which considered in itself is particular, becomes general, by being made to represent or stand for all other particular ideas of the same sort;' and he instances this in the case of any particular length, an inch, for example; which, to a geometer, he says, becomes general, as it represents all particular lines whatsoever; so that what is demonstrated of it, is demonstrated

of all lines, or, in other words, of a line in general. It is truly inconceivable that he should not have discovered, in this very statement, that he had taken for granted the existence of general notions, the very states of mind which he denied; since, without these, there can be no meaning in the restriction of any sign to 'ideas of the same sort.'

But it is not necessary to accompany Dr. Brown farther in the process of a refutation of such mysticism and unmeaningness or absurdity as that of Berkeley and others in defence or definition of nominalism. The following is the conclusion of the whole.

'In the case of nominalism, as in many other cases, I have no doubt, notwithstanding the apparent extravagance of the paradox, that it is because the doctrine of the nominalists is very contrary to our feelings, we do not immediately discover it to be so. If it were nearer the truth we should probably discover the error which it involves much more readily. The error escapes us because our general terms convey so immediately to our mind that common relation which they denote, that we supply of ourselves, what is wanting in the process as described by the nominalist; the feelings of the circumstances of resemblance, specific or generic, that are to guide us in the application as they led us to the invention of our terms. We know what it is which he means, when he speaks of particular terms, or particular ideas, that became more generally significant by standing for ideas of the same sort, or the same order, or species, or genus, or kind; and we therefore make for him, by the natural spontaneous suggestions of our own mind, the extension and limitation which would be impossible on his own system. But for such an illusion it seems scarcely impossible to understand how so many, of the first names of which our science can boast, should be found among the defenders of an opinion which makes reasoning nothing more than a mere play upon words, or, at best, reduces very nearly to the same level the profoundest ratiocinations of intellectual, or physical, or mathematical philosophy, and the technical labors of the grammarian or the lexicographer.'

The system of the nominalists then, though more simple than that of the realists, is not, any more than it, a faithful statement of the process of generalisation. It is true as it rejects the existence of any universal form or species, distinct from our mere feeling of general resemblance. But it is false as it rejects the general relative feeling itself, which every general term denotes, and without which, to direct us in the extension and limitation of our terms, we should be in danger of giving the name of triangle as much to a square or circle, as to any three-sided figure. We perceive objects, we have a feeling or general notion of their resemblance, we express this general notion by a general term. Such is the process of which we are conscious; and no system which omits any part of the process can be a faithful picture of our consciousness.

We have alluded above to Mr. Locke's notable general triangle. As it is calculated to set his metaphysical mastery in a striking light, when he ventured to quit his guides and attempt originality, we quote the passage which may be found by the reader in turning to Book IV. chap. vii. sect. 9, of the Essay concerning Human Understanding:—'Does it not require some pains and skill,' says Mr. Locke, 'to form the general idea of a triangle (which is yet none of the most abstract, comprehensive, and difficult)? for it must be neither oblique nor rectangle, neither equilateral, equicrural, nor scalenon; but all and none of these at once. In effect it is something imperfect that cannot exist; an idea wherein some parts of several different and inconsistent ideas are put together.'

This is surely worthy of being preserved as a precious metaphysical relic of Mr. Locke, and in confirmation of the old testimony of Cicero respecting nothing being too absurd to be found in the writings of philosophers. Mr. Locke may be designated a conceptualist, to discriminate him (as intermediate) from the realists on the one extreme, and the nominalists on the other; but, in reference to either, his idea was confusion worse confounded. Dr. Brown is at some pains to show (as Mr. Stewart is indefatigable in showing, in reference to his making reflection a distinct origin of ideas), that Mr. Locke meant well in this matter: and none can have a higher opinion of his good intentions than we have. He was truly, in the very highest sense of the expression, a well-meaning man. As in all practical and less abstract concerns sensible and judicious, as a truly good man, as the friend of human improvement and happiness, as the advocate, and in some sense a father, of civil and religious liberty, or, at least, of just notions concerning them, we revere and love his memory. But we cannot prostrate our understanding to him as a metaphysical object of worship, or sincerely profess to admire him as possessed of extraordinary intellectual acuteness, originality, depth, or comprehension.

As an ulterior step, in the discussion of relative suggestion, Dr. Brown proceeds in the forty-eighth lecture to give an analysis of the process of reasoning; and we shall endeavour to extract from it what seems most essentially important.

'On that class of our relative suggestions which involves the feeling of the relation of the parts comprehended to the comprehending whole, it will be necessary to bestow some more illustration, that you may understand clearly the nature of the process of reasoning; that most important of all our mental processes, which logicians and metaphysicians have contrived to render so obscure, but which is in itself nothing more than a series of felt relations of this particular class in the instances of which I selected before, of a house and its apartments; a tree and its stems and foliage; a horse and its head and limbs and trunk. The relation which I have termed the relation of comprehension, or comprehensiveness, is so very obvious, that a mere allusion to it is sufficient, without any commentary.

'When I think of cases in which the relation is of a substance to parts that are themselves substances, as when I say that a room is a part of a house, or that a tree has branches, it is quite

evident that in these very simple propositions I merely state the relation of parts to a comprehending whole. But is the statement at all different when I speak, in the common forms of a proposition, of the qualities of objects; when I say, for example, that snow is white, man is capable of reasoning, the wisest of mankind is fallible? do I not merely state one of the many qualities, comprehended in that totality of qualities, which constitute the subject as known to me? I do not indeed divide a mass into its integral parts, but I divide a complex notion into its parts, or at least separate from that complexity a quantity which I feel to belong, and state to belong, to that complex notion from which I have detached it. It is as it were a little analysis and synthesis. I decompose, and, expressing to others the mental decomposition which I have made, I combine again the separated elements of my thought, not indeed in the same manner (for the analytic process is as different as matter is from mind), but with the same feeling of agreement or identity that rises in the mind of a chemist when he has reduced to one mass the very elements into which he had transmuted the mass, by some one of the analyses of his wonderful art.'

What then is reasoning (which is nothing more than a number of propositions consecutive in a certain order) but a continued series of analytical operations of this kind, developing the elements of our thought? In every proposition that which is affirmed is a part of that of which it is affirmed, and the proposition, however technical its language may be, expresses only the single feeling of this relation.

Whatever be the species of reasoning, however, it is necessary that the proportions which form the reasoning should follow each other in a certain order; for without this order, though each proposition might involve some little analysis, and consequently some little accession of knowledge, the knowledge thus acquired must be very limited. There could be no deduction of remote conclusions, by which the primary object of a distant proposition might be shown, through a long succession of analyses, to have properties which required all these various evolutions before they could themselves be evolved to view. In the proportional reasonings of geometry, we know well that the omission of a single proposition, or even a change of its place, might render apparently false, and almost inconceivable by us, a conclusion which, but for such omission or change of place of a few words of the demonstration, we should have adopted instantly, with a feeling of the absolute impossibility of resisting its evidence.

To constitute reasoning it is necessary that there should be some mutual relation of the subjects and predicates of the different propositions. The order of the different propositions is so arranged, as to present to us this mutual relation of the successive subjects and predicates; it is therefore of the utmost importance to our consecutive analyses, in the reasonings that are strictly analytic, and to our consecutive measurements in the reasonings which are proportional. On what does this order depend?

The common opinion on the subject makes this order a very easy matter. We have a certain sagacity, it is said, by which we find out the intervening propositions, and they are arranged in the proper order because we have discovered them to be suitable for our measurement, and put them in their proper places. 'Those intervening ideas which serve to show the agreement of any two others,' says Locke, 'are called proofs. A quickness in the mind to find out these intermediate ideas (that shall discover the agreement or disagreement of any other), and to apply them rightly, is, I suppose, that which is called sagacity.' And reason itself he elsewhere defines to be the faculty which finds out these means and rightly applies them. We need not quote the common expressions to the same purport which are to be found in other writers.

The sagacity of which Locke and other writers speak, may (since it is nothing more than a form of our simple suggestion itself) be reduced to that peculiar tendency of the suggesting principle, varying in different minds, of which we have before treated, when considering the secondary laws of suggestion in their relation to original genius. The same objects do not suggest to all the same objects even where past observation and experience may have been the same; because the peculiar suggestions of the objects, the relations of which are afterwards felt, depend in a great measure also on tendencies modified by long habit, and therefore varying in different individuals as these habits may have been different. To some minds (the common minds which in the great multitudes of our race think what others have thought, and do what others have done) the conceptions which form their trains of memory, that scarcely can be called trains of reflection, rise, as we have seen, according to the relation of mere contiguity, or former proximity in time, of the related images. The conceptions of minds of a higher order rise in almost infinite variety, because they rise according to a relation which does not depend on former co-existence of the very images themselves, but is itself almost infinitely various.

The differences of opinion in mankind, far from being wonderful, are such as must have arisen though there had been no other cause of difference than the variety of the conceptions, which by the simple laws of suggestion, occur in the various trains of thought of individuals, diversifying of course the order of propositions in their reasonings, and consequently the relation which the conclusion involves. The objects compared have, at every stage of the argument, been different; and the results of the comparison of different objects, therefore, cannot well be expected to be the same.

Having resolved the whole process of reasoning into simple suggestion, as so fully and clearl explained by him, Dr. Brown adverts to the syllogistic art, which so long reigned triumphant in the schools, and which still lingers in the fond embrace of a certain description of logical professors. We have already given the substance of his statement at the conclusion of the article LOGIC, to

which we refer the reader. The futility and absurdity of the syllogism are now almost universally admitted; and if any syllogistic admirers are to be found, on whom the remarks of Dr. Brown have had no effect, we know not that it would be of any use to reason with them. It may be enquired, however, if the old logic be exploded are we not to have something better as a substitute? In reply, our author justly remarks, 'The art of reasoning which a judicious logic affords is not so much the art of acquiring knowledge as the art of communicating it to others, or of recording it in the manner that may be most profitable for our own future advancement in the track which we have been pursuing. Its direct benefit to ourselves is rather negative than positive, teaching us the courses of error in our mental constitution, and in all the accidental circumstances of the language which we are obliged to use of the society in which we must mingle. Its office is to deliver us from what is false, rather than to confer on us what is true. Indeed, since we cannot, as already shown, produce directly in our mind any one conception, or any one feeling of relation, it is very evident that the influence of any art of reasoning on our train of thought must be indirect only.'

Men are fond of art and rules, but these have little of positive utility: they never yet made a good reasoner any more than a great poet. After all that has been said of the conduct of the understanding, the best rule of right reasoning that can be given is, Guard against the various causes of error and imposition, and particularly against that grand imposture the imposition of words. The great error of the theory of the syllogism (and it is an error which may operate when the syllogism itself is discarded) consisted in supposing that, because all our knowledge may be technically reduced in some measure to general maxims, these maxims have naturally a prior and paramount existence in our thought, and give rise to those very reasonings, which, on the contrary, give rise to them.

As has been fully shown, we trust, judgment, which makes such a figure in the language and theories of logicians and metaphysicians as a faculty or power of the mind, is nothing but a feeling of relation; nor is reason, which also makes such a figure as a sort of distinct if not independent faculty, any thing but a series of judgments or felt relations. 'Those,' says Dr. Brown, 'who ascribe judgment to man, ascribe to him also another faculty which they distinguish by the name of reason: though reasoning itself is found, when analysed, to be nothing more than a series of judgments. The whole is thus represented as something different from all the parts which compose it. Whether we reason syllogistically with the schoolmen, or according to those simple processes of thought which nature teaches, our reasoning is divisible into a number of consecutive judgments, or feelings of relation; and, if we take away these consecutive judgments, we leave nothing behind which can be called a ratiocination. In a simple proposition we take one step, or feel one relation; in an enthymeme we take two steps, or feel two relations; in a syllogism we take three steps, or feel three relations; but we never think, when we speak of the motion of our limbs, that the power of taking three steps differs essentially from the power of taking one; and that we must, therefore, invent new names of bodily faculties for every slight variety, or even every simple repetition of movement.

'The circumstance which led to the distinction of reason from judgment was not so much the mere length and mutual connexion of the series, as that mistake with respect to the power falsely ascribed to the mind, of finding out by some voluntary process the intervening propositions which serve as the medium of proof. The error of this is now, we trust, sufficiently manifest.

'Another faculty with which the mind has been enriched by systematic writers who have ranged the different states of the mind into many powers or faculties is abstraction; a faculty by which we are supposed to be capable of separating in our thoughts certain parts of our complex notions, and of considering them thus abstract from the rest. This supposed faculty, however, is not merely unreal but impossible, since every exertion of it would imply a contradiction. In abstraction the mind is supposed to single out a particular part of some one of its complex notions for particular consideration. But what is the state of the mind immediately preceding this intentional separation, its state at the moment in which the supposed faculty is conceived to be called into exercise? Does it not involve necessarily the very abstraction which it is supposed to produce? and must we not, therefore, in admitting such a power of voluntary separation, admit an infinite series of preceding abstractions, to account for a single act of abstraction? If we know what we single out, we have already performed all the separation which is necessary; if we do not know what we are singling out, and do not even know that we are singling out any thing, the separate parts of the complex whole, may, indeed, rise to our conception (as they do rise), but it cannot arise by the operation of any voluntary faculty.

'I have now,' he says, 'brought to a conclusion my analysis of the intellectual phenomena; and have endeavoured to show that, though commonly ascribed to many distinct faculties, they are all truly referrible only to two, the capacity of simple suggestion, which gives to us conceptions of external objects, formerly perceived, and of all the variety of our past internal feelings, as mere conceptions of fainter images of the past; and a capacity of relative suggestion by which the objects of our perception or conception that are themselves separate no longer appear to us separate, but are instantly invested by us with various relations that seem to bind them to each other, as if our mind could give its own unity to the innumerable objects which it comprehends.'

We have now followed the lecturer step by step through his whole course of intellectual investigation, and have omitted as little as possible of the topics that seemed most material. We cannot at present proceed with him to the consideration of our emotions, or, as commonly termed, passions; but we hope to bring him

soon again before the public in connexion with these. It remains that we very hastily say a few words concerning our task, concerning our author, and concerning the science or philosophy of mind as now presented by the investigations of the late professor of moral philosophy in the university of Edinburgh.

We know not what satisfaction or dissatisfaction our attempt in reference to Dr. Brown will give to our readers; we have not been able wholly to satisfy ourselves, and have only the consolation of the fullest consciousness that we meant well. We have endeavoured (often unsuccessfully we fear) to popularise the greatest metaphysician of the age, to bring him down to the level and within the reach of the perception and appreciation of the general reader. In this endeavour we have sincerely desired to confer honor on the one and a benefit on the other. We have, we trust, taken no unwarrantable liberties with the lectures, of which we have made so much use. In extracting from them we have altered, abridged, and extended by turns. Hence we have sometimes omitted quotation marks when quotations have been made almost verbatim; but we have, in these cases, both directly and indirectly apprised the reader that the truly great moral professor was addressing them. With readers who feel any interest in such enquiries, what we have done is calculated, as it is really intended, not to mar but to promote the reputation of Dr. Brown's Lectures on the Philosophy of the Human Mind. Thus much, candid reader, we have thought necessary to say in reference to ourselves. We willingly hasten away from self to the object of our admiration and gratitude.

The reader must be already fully aware that we estimate the intellectual merits of Dr. Brown very highly. We consider him as one of the most original, profound, comprehensive, and sound thinkers of any age or country. For metaphysical acuteness, and discriminative subtilty, and masterly analysation, he stands unrivalled. There is, indeed, an excess of this kind of excellence, which rather mars his general merits, the utility of his intellectual labors, and the measure of his fame. But take him for all in all, as an intellectual philosopher, we know of but one who has any title to dispute or divide with him the pre-eminence, a pre-eminence of the highest altitude above the reach of other aspirants. As to the northern lights that played, and all the stars that twinkled in the metaphysical hemisphere, they must hide their diminished heads in the presence of this glorious orb of day. Nothing but another night of metaphysics could render them beautiful and attractive: a voluntary descent into the deep well of scholastic notions and jargon would be almost necessary to render stars which once shone with much brilliancy any longer visible.

This may seem extravagance, and we may have put the case somewhat hyperbolically, but the reader must not suppose that we are unreserved admirers or blind idolaters of Dr. Brown. His excellencies are of the rarest and highest order, but they are not free from some alloy of defect. He will bear a favorable comparison with his distinguished metaphysical predecessor (who was unquestionably in part his prototype); but in some respects he is a complete contrast to the philosopher of Malmesbury. Dr. Brown is often too subtile, almost always too wordy, and consequently he is very generally deficient in the important article of lucidus ordo, or perspicuity. It is often, indeed, a very great intellectual exertion to understand him. His style is radically defective considered as a medium or instrument of imparting his conceptions, and is just the reverse of Hobbes's, as so happily characterised by Sheffield, duke of Buckingham. We may say of it frequently what he himself has said of time (considered as an abstract entity) by way of compliment to St. Austin and the illustrious pupil of Dr. Reid. 'Instead of growing clearer as we gaze upon it, it grows more obscure beneath our very gaze.' Indeed our greatest wonder of all is how he should have accomplished so much with such a bad instrument, or with such unskilful management of the verbal apparatus—the most demonstrative evidence, perhaps, that could have been given of his being possessed of that creative genius which gives a sort of omnipotent independence of means or instruments. We do not now wonder at what we have heard sneeringly said of him in his life-time, that his poetry was bad prose, and his prose bad poetry. It is richly intellectual and occasionally truly eloquent, but there is a confusion and wildness about its magnificence that dazzle and distract the 'suggesting principle' of the beholder. There never was, perhaps, such a striking illustration of the old quotation, that 'obscurity is the usual result of laborious efforts to be explicit. Dr. Brown attempts too much, and therefore often fails altogether. He is too minute, he crowds so many topics and circumstances into the map which he gives of his mind or ratiocination that we can sometimes at least perceive nothing distinctly. He is not content with the most important points of a view or steps of a process; he leaves nothing to the mind of the reader or to the exercise of the suggesting principle—he overwhelms it with circumstances of the minutest and fullest possible information. He is as lavishly circumstantial with the metaphysical enquirer as Mrs. Quickly with Sir John Falstaff, who would not only not suffer the worthy knight to forget any thing but would not suffer him to remember any thing of his own accord.

Dr. Brown's lectures, might however be modified and condensed into the most useful and popular metaphysical book ever given to the world. As they now stand, we fear they will not be very popular, and there will be some danger of subsequent moral professors marring and spoiling all, as Locke did the intellectual philosophy of old Hobbes.

Much of the evil we have to complain of is doubtless, ascribable to the hurried manner in which (to use a sort of cant but significant phrase) the lectures were got up, for they cannot be said to have been prepared for delivery, much less for publication. Almost every one of them, it appears, was written at the urgent call of necessity; or, as we usually say, on the spur of the moment, in the short space of a few hours on the night, or morning even, immediately pre-

ceding the reading of it to the moral philosophy class in the university of Edinburgh. This too is certainly calculated to fill us with amazement at Dr. Brown's strength of mind; yet we cannot but regret the circumstance as much as his style itself. It is possible indeed, nay probable, we suspect, that, if the lectures had not been written in breathless haste or urgent hurry, they would not have been written at all, any more than Johnson's Rambler or Rasselas. We are not sure, however, about the soundness of the opinion of the author himself, as well as of his friend and biographer, as if the excellence of the lectures were mainly ascribable to the high excitement, that is hurry, under which they were written. High excitement is indeed favorable in a well-stored mind, to torrents of discussion or bursts of eloquence; but it is not favorable to arrangement and condensation—to clearness and brevity. These all-important qualities of metaphysical compositions require cool judgment, 'waiting for thought' (to which Newton ascribes so much of his merit as a physical philosopher), and patient reflection. Probably Hobbes spent more time in condensing and lucidising one of his short chapters, than Dr. Brown did in writing several of his long lectures.

We are told, indeed, by the excellent and reverend biographer of Dr. Brown, that, when he returned afterwards to the examination of his lectures, he found that he could make very little improvement upon them, which he accounted for by the high excitement under which they were written, being peculiarly favorable to intellectual exertion or effort. That he could not find much in his own compositions, after a short lapse of time, which seemed to require alteration or amendment is not very wonderful. When we come, particularly in a sluggish state of mind, to the examination of our own compositions, we are easily satisfied; nor is it always easy to improve even very bad ones; besides, we catch anew the delightful enthusiasm under which we produced them at first—the affection with which we gazed in the first moments of their existence upon our intellectual offspring—and love, particularly parental love, is proverbially partial if not blind. Even when we have a vivid remembrance of having written something on a given subject before, though we know not well what, and are determined not to look at it, there is something of disqualification about our mind to write better upon it anew; because the mind, instead of vigorously applying to the subject is wandering or hankering after its former production. If we may be allowed to reclaim for a moment our old multitude of faculties (and really it is hard to do without them, the loss of them will deprive us of much 'revelry and ease'), we would compare them to a long team drawing tandem-wise. The first horse is genius, the second imagination, the third memory, the fourth judgment, the fifth reason, and so on to the end of the whole series. If they be all well trained and in good condition, and draw one way, the whole intellectual machine will move forwards more or less surely and steadily in the right direction; but if any of them be restive or refractory, or draw awry—if, for instance, memory be always struggling to escape, or flying to one side after something it has enjoyed before, and that it is still very fond of, it is evident the team cannot advance—the whole intellectual machine must either remain stationary or be tumbled upside down. It is somewhat after this ludicrous and absurd image of the mind and its faculties, when we do not apply with all our might to intellectual subjects which we have already discussed. It is a difficult task to decompose and recompose anew our own compositions. If it were not so, how could Dr. Brown yield himself tamely up to an idle theory about the wonder-working intellectual power of high excitement? How could he imagine that he could find little or nothing to require alteration, or to admit of improvement, in lectures written in the hurry of a few hours. Might he not (especially if he contemplated publication) have lopped off a thousand repetitions and redundancies? Might he not have improved a thousand passages by reducing them to a simpler, and clearer, and more tangible form? Might he not have compressed four volumes into two?

We will put a sort of ad hominem case to the reverend biographer of Dr. Brown, merely for his convincement; and we take it for granted that his phrenology has nothing to do with the question. We doubt not that he has two sorts of preparation for the pulpit. Sometimes he chooses his subject early, he feels deep interest in it, he wishes to do it full justice, and gives himself full time for the purpose; at other times he drives, as we say, the business of preparation off to the last; and, when he must delay it no longer, falls to work with all his might on Saturday evening, and writes doggedly, as Johnson expresses it, or under a high degree of excitement, according to Dr. Brown. Perhaps if he were to re-examine, after some lapse of time, a production of the last sort, he might find very little in it that he could alter or improve; but which of the two descriptions of preparation for the pulpit would he coolly and deliberately send to the press? But we have, perhaps, dwelt too long on the topic, though it is quite as important as any abstract or metaphysical discussion to correct an unsound opinion respecting the high excitement of breathless hurry, as favorable to intellectual effort or exertion not only in rhetorical, but even in metaphysical productions.

Though we have insisted so much on the objectionable character of Dr. Brown's general style, the reader must not suppose that he could not write well, or express himself clearly, concisely, and forcibly. Many very admirable passages, in every view of them, might be extracted from his lectures, in addition to some that we have given. He almost always writes like a man of thoughts rather than of words, and fully conscious that he had abundance of intellectual treasure to draw upon, and on which he might safely rely for effect. There is little or nothing of elegant verbiage or pompous grandiloquence about him. He will bear an advantageous comparison in this respect with even professor Playfair, who appears in all the simplicity, and dignity, and native grandeur, of a true philosopher. He does occasionally employ such ex-

pressions as philosophy of the mind, science of mind, phenomena of mind, laws of mind, &c.; but he evidently cared little for them, and would have been willing to do without them, and he was careful to explain how much or rather how little is meant by them. He did not ring changes upon them, or constantly repeat them in an eternal circle. There was nothing of philosophic cant or affectation about Dr. Brown. When, indeed, a general habit of grandiloquence is once established, as it has been with us as well as with the French, something of it is absolutely necessary to command attention, and even to convey meaning. When 'all the world is a stage, and all the men and women merely players,' we cannot perform our part without something of dramatic artifice.

But we must come to a conclusion by very briefly attempting an estimate of the amount and value of metaphysical knowledge.

It is sufficiently evident, from what has been already advanced, that if there be any thing that deserves the name of a science or philosophy of mind, it must henceforth be 'put on a footing almost entirely new,' as Hume expressed himself on the subject. The science of mind, as propounded by Dr. Reid and his illustrious pupil, instead of progressing onward ad infinitum towards infinitesimal perfection, has been wholly overthrown. It has been as completely subverted as the dynasty of the Stuarts. There has been a revolution effected in the philosophy of mind far more radical and entire than the political revolution brought in with William and Mary 'of glorious memory.' Whether it shall be of permanent stability, and its results of a progressively beneficial kind on the knowledge, and wisdom, and happiness of human beings—whether it shall accelerate the march of intellect, and its author shall be pronounced the immortal Brown, and the father of the true, experimental, inductive science of man, by a grateful and applauding posterity, is more than we dare venture to predict. Yet we think his memory will wear well, and that it has something imperishable about it. Indeed his doctrine of human nature is, we conceive, the only one since that of Hobbes (upon which it is certainly a decided improvement, as Locke's Essay and Hartley's Theory of Man were as decided deteriorations) which has any fair pretension to be considered a true statement of accurate analysis. There is much in Dr. Brown's lectures, to minds in unison with our own, that may be truly called the feast of reason and the flow of soul; nor are we wholly faithless or hopeless as to beneficial results on all kinds of philosophies, high and low, great and small. But after all, if we were closely pressed to state, in the fewest possible words, the sum total or actual amount of positive good, or of the intellectual benefaction conferred on the world by the extraordinary analytical genius of Dr. Brown, we should be somewhat perplexed. The good is of a negative rather than a positive kind. He has done much to disabuse our poor understandings, and the man that does that is a benefactor and a reformer, worthy of ranking with Martin Luther and John Knox. He who successfully detects the absurdity, and exposes the folly, of a vain and deceitful philosophy, deserves to be held in grateful remembrance. It is at least something to place us in that intellectual condition in which we might have been if such men as Aristotle had never existed, and to prevail upon our busy, meddling minds 'to stop when at the utmost extent of their tether,' as good Mr. Locke says, 'and to sit down in a quiet ignorance of those things which are found to be beyond the reach of our capacities,' without adding to all the other disquiets of this imperfect state, by torturing our frail intellects, and heating our unruly passions, with such entities and quiddities as those of the doctrines and jargon of the schoolmen.

We are not easily satisfied, however, with negative qualities in the philosophy of mind; if an old venerable pile of intellectual incumbrance and nuisance be removed, we would straightway have something large, and stately, and imposing, erected in the room of it, even if the new erection should prove nearly as much of an obstruction, incumbrance, and nuisance, as the old one. This is the danger here—instead of reforming the reformation of Dr. Brown, we have no doubt that vigorous efforts will be made by moral professors to graft upon it the old notions, or to bring it back again to something of decent conformity with the splendor and pomp of the very system which was renounced and abandoned on account of its absurdities and impostures.

We may talk largely and loftily about our philosophy of the mind, but the mind has an occult philosophy or way of its own, that mocks our experimental and inductive researches and analytic processes. The whole of the intellectual science, as Hobbes, and Descartes, and Malebranche, and others long ago said, and as no one who reflects for a moment can dispute, must rest upon consciousness; but consciousness is a sandy foundation, soon shaken. It is so shifty and shadowy, that to attempt to rest much upon it is almost like building castles in the air. Indeed how shall we proceed to bring different intellectual philosophers to agree either about what it is, or what is its testimony? For nothing can be more opposite and conflicting than their doctrines concerning both. There is abundant concord between the consciousness of Dr. Brown and our own, and therefore we think his doctrine the true one; but, if a disciple of Kant or of Dr. Reid were to choose to dispute the matter with us, it would be hopeless, or rather absurd, to attempt mutual convincement and agreement. He sets up his consciousness against ours, and we set up our consciousness against his; and there we are without a single particle of intellectual data in common to start with about the science of the mind.

As it is with the foundation itself of the whole science, so it is with all the intellectual phenomena, which according to Condillac are nothing whatever but the ghosts of departed sensations; and, though we think the French philosopher decidedly wrong here, yet there is something like the evidence of analogy about the notion too; for we might as well attempt to conjure up spirits

from the vasty deep as hope to will up any of the intellectual phenomena at pleasure. We might as well expect to put the ghost of Richard III. upon the rack to make it confess any facts respecting his nephews, as attempt to submit any of the intellectual phenomena to the experimentum crucis to make them give sure and faithful testimony concerning true and false philosophies of the mind. The mental phenomena indeed are not only a shadowy but a shy race of entities, as skilful and persevering in flight as the old Parthians; and 'retire the more the more we press.'

We may indeed get a sly peep of them occasionally, as of our own shadow over our shoulder when walking along by moon-light. But, if we turn directly round upon them, they instantly run off, and it is of no use whatever to run after them. It is as impossible to seize them and make them our prisoners, for permanent data or intellectual dissection, as to share in the deliberations of a tribe of fairies when assembled, it may be, in some adjoining field or wood under the light of the same moon to discuss metaphysical or political questions of the gravest importance. We only yield to the suggesting principle in remarking that the mental phenomena are often most vivid and strongly marked or most powerfully active in the dead hour of night when we are fast asleep; and according to Hobbes these nightly vigils or operations of the mental phenomena commonly called dreams (whether from dormio to sleep, or drama we are not sure), are the prototypes of all the mythological personages of all ages and countries, or the true and original ghosts and goblins, fairies and brownies, of all the races and tribes of men. There is some show of plausibility about this notion of the old philosopher, but what we meant to remark was the difficulty of managing and dissecting the mental phenomena, or of dealing with them in any way whatever. Many of our dreams seem at first sight to have made such a deep and lasting impression as to have become a part of our mental identity; and as that we shall have no trouble with them, any more than with our identity itself, but may analyse them at our leisure. But we are scarcely wide awake and ready for work when the subjects, on which we meant to operate for the purpose of making further discoveries in the anatomy or physiology of the mind, have vanished away; and we have the mortification as intellectual physiologists of finding that all was but the 'baseless fabric of a vision that leaves not even a wreck behind.' But enough; we only meant to abate the pride and pretension of intellectual philosophy, and to chasten and subdue its grandiloquence respecting mental data, phenomena, well ascertained facts, experimental researches, inductive reasonings, &c. &c., in the science of mind. Indeed, how any man in his sober senses, consciousness, and reflection, should seriously write about the subject in the manner Mr. Stewart does, is to us one of the most wonderful phenomena in the whole range of our poor limited observation.

Dr. Brown has done much, as already intimated, because he has simplified metaphysical matters very considerably. He has nullified much mystical jargon and visionary reasoning. He has swept away the whole multitude of mental powers and faculties created or conjured up by Dr. Reid out of the vasty deep of his mere imagination. He has reduced all that we know about the operations of the mind to simple and relative suggestion. And this seems as satisfactory an account of the matter as can be given. It is not wonderful that what is usually called (in consequence of Locke's having so termed what had been pointed out to him by Hobbes) association of ideas, should have been much philosophised about; for it is so obviously connected with consciousness, and so strikingly presented in a thousand different ways to our observation and reflection, that it is hardly possible to conceive than any human being should be so dull as not to be aware of it. Probably too the most illiterate peasant knows nearly if not quite as much about the matter as the profoundest philosopher. The chief, if not only difference between the two is, that the peasant never thought of philosophising about it as if he had made a grand discovery in the science of mind unknown to all the world beside; and, if he were to think of putting forth his thoughts concerning it, he would not be able to express them in all the pomp and circumstance of philosophic language. The following couplet of some poor poetaster was received into the mind of the writer of this paper at such an early period of life that he has no remembrance of its reception; it may therefore be in some sense considered older as a part or parcel of his mind than his very mental identity itself. Indeed he could almost fancy it to be innate, so completely unconscious is he of its intromission. It implies, however, the principle of suggestion or association as fully as any statement of Hobbes, Locke, Hartley, Hume, or Brown. Nor can he remember a time when he was ignorant of what it implies, or when he was not aware of the principle. The miserable couplet referred to is,

Dumbarton drum beats bonny O,
It minds me of my Jonny O.

This might be expressed or supposed to be expressed by an affectionate mother, whose son had left her to 'follow the drum,' as Burns expresses it; or more probably by some love-sick maid the object of whose affections (not good for much perhaps) had left her all forlorn to go and fight for his king and country. But, whatever were the occasion and the circumstances of the said couplet, the suggesting or associating principle is fully implied. Indeed the difficulty would be to find any kind of composition in which it is not implied. Instances almost innumerable might be presented to show that the least informed and philosophic of men are aware of the principle, and avail themselves of it too for practical purposes as much as if Dr. Hartley had lectured to them for a whole year upon the subject. When for instance the plain honest tradesman who wishes not to forget some one thing which is to be attended to, after some short space of time, ties one knot on the corner of his pocket hankerchief, or if he wishes to make two memorandums upon it ties two knots, what is he doing but practically philosophising (not the worst kind of philosophy

after all) upon the suggesting principle or association of ideas?

It may be thought, however, that the true science or philosophy of the mind, must be of vast importance for theorising this grand principle of our mental constitution into the greatest possible availableness for useful purposes and application, so as to promote knowledge and wisdom, and virtue, and happiness. We should be glad to know what it has done or what it can do in this way. Having some portion of parental solicitude, we turned lately with considerable intensity of desire to the article Education in the Supplement to the Encyclopædia Britannica, which we supposed must have been written by some great intellectual philosopher or other. But alas! when we arrived at the end of the whole matter it was with the mortification of finding that the title of the last chapter of Rasselas might have been an appropriate close. 'The conclusion in which nothing is concluded.' We found indeed that the writer belonged to neither the German nor Scottish school of metaphysics, that he was a great admirer of Locke, Hartley, Condillac, Helvetius, and somewhat partial to Cabanus, that he was probably a materialist and antireligionist, but that was about the amount of discovery and conjecture. A few tritical remarks in reference to the suggesting or associating principle, such as almost any well-informed tradesman, in the present intellectual state of society, could make, were all that could be found answering to the title of the article. Surely society does not now require to be told by intellectual philosophers that it is wrong to associate the idea of ghosts and goblins with darkness in the minds of children; or the idea of merit with a fine coat or splendid mansion. This is professedly an age of improvement, and we think it is not all mere talk; but we must yet draw upon hope rather than fruition. We hope that the science or philosophy of political economy, of medicine or the healing art, of agriculture, of education, and all the other sciences and philosophies any way connected with the being and well-being of men, will rapidly progress to a state of the highest perfection; but we are afraid that the science of man himself, or the philosophy of mind, will not assist much in the simultaneous movements of progression so devoutly to be wished.

There is one topic more to which we must devote a few remarks. Is there a necessary connexion between metaphysics, or as termed by Mr. Stewart the philosophy of the mind, and religion? According to that author's representations, the philosophy of the mind is the foundation of, or, at least, it is necessary to natural religion; which again is the necessary foundation of revealed religion. We have no doubt as to the goodness of his intentions in this matter, but we have considerable doubt as to the soundness of his judgment. And we fear that he, and Dr. Reid, and Dr. Beattie, have done no small disservice to the very cause which they intended to support; and for the support of which indeed their system of metaphysics was taken up: a most unfortunate circumstance too, for that cause, as distrust and suspicion are almost sure to be excited in inquisitive minds, when a set of principles, or a theory, is assumed for an obvious or avowed purpose. It is generally believed that there is a considerable portion of scepticism or disbelief as to religion, to be found among the highest classes of intellectual men in Scotland, and particularly in the Scottish capital. We do not wonder at the fact, and we conceive that, though not wholly ascribable to the Scottish metaphysics, yet they must (like those of Leibnitz and after him those of Kant in Germany) have had considerable influence. But without entering into the general merits of the Scottish metaphysicians who arrayed themselves against Hume, as to their ability or inability to contend with such an opponent, let us consider the natural tendency of their mode of proceeding. They adopt a certain set of metaphysical notions in support of natural religion, which natural religion is considered necessary to revealed religion. The one is the superstructure, the other is the foundation. Of course the superstructure requires only a secondary and very subordinate care or concern. All the energies of the guardians of religion are to be directed to the preserving of the foundation secure and entire. A certain set of metaphysical notions are thought to be necessary for this purpose, and therefore they are adopted.—Ultimate principles of our nature are created ad libitum; powers and faculties are conferred upon the human mind, almost without number; for it seemed the more of them the better, and the mightier the entrenchments and bulwarks thrown around that sole foundation of all that is great and good, natural religion. Dr. Reid went on creating powers and faculties for the human mind, and arranging them in due order, giving intimations too that all the powers and faculties were not conjured up yet, and that only a sample of them was published. But his grand achievment was the overthrow of the ideal system; and, having ceased from all his metaphysical labors, his illustrious pupil commenced his career as author of the philosophy of the mind, and nothing almost was heard of but experimental researches and inductive reasonings concerning mental data, and phenomena, and many other magnificent entities. Many were dazzled and delighted with all this success and triumph, and renown of the common-sense or Scottish metaphysics, which seemed to have put scepticism and infidelity to flight. Meanwhile, among the more reflecting deep-searching few, some laughed and others grieved, according as they were well or ill affected to real religion—that religion which is not in word only but in deed and in truth.

When Mr. Stewart retires from the chair of moral philosophy, Dr. Brown succeeds him, and with a metaphysical mastery of the highest order he overthrows all the philosophy of the mind set up in Scotland by Dr. Reid and his illustrious pupil. What conclusion would many be apt to come to who have observed all this? They would certainly be ready to argue that religion natural or revealed can stand no longer; and no doubt the representations given by Dr. Reid and Mr. Stewart of their true theory of the mind are but too much calculated to produce that opinion. Hence it is that injudicious friends are often

more prejudicial to a good cause than avowed enemies. We cannot dwell longer on the subject here. We merely add that in our humble judgment the doctrines of professor Brown bear an infinitely more favorable aspect to true religion and morality, and human well-being, than those of professor Stewart.

METAPLASM, *n. s.* Lat. *metaplasmus*; of Gr. μετα, and πλασσω, fingo, in grammar, a change made in a word, by adding, retrenching, or altering a letter or syllable.

METAPONTIUM, or METAPONTUM, in ancient geography, a town of Lucania, on the Sinus Tarentinus, west of Tarentum; built by the Pylians, who returned from Troy.—Mela; where Pythagoras is said to have taught in the time of Servius Tullius.—Livy; and the people pretended to show, in a temple of Minerva, the tools with which Epeus built the wooden horse of Troy.—Justin. It is now a tower, called Torre di Mare, in the Basilicata

METASTASIS, *n. s.* Gr. μεταστάσις. Translation or removal; applied particularly to diseases.

His disease was a dangerous asthma; the cause a *metastasis*, or translation of tartarous humours from his joints to his lungs. *Harvey on Consumptions.*

It is scarcely necessary here to point out examples of the *metastasis* of diseases, which are universally recognised · such are the severe attacks of disorders in the stomach, when the inflammatory gout suddenly disappears from the extremities; the occurrence of diarrhœa or dysentery, upon the sudden retrocession of the measles, or other extensive eruption of the skin; the appearance of epileptic convulsions upon the cessation of the hæmorrhoidal, or other habitual discharge; the inflammation of the testes in men, or of the mammæ in women, which ensues, when that of the parotid glands in the disease called mumps, suddenly disappears; and other cases of a similar nature. *Dr. A. Rees.*

METASTASIO (Abbé Peter Bonaventure), whose real name was Trapassi, was born in Rome in 1698. His talent for poetry was first unfolded by reading Tasso; and he began to compose verses at ten years of age, which procured him the patronage of the celebrated Gravina. He was only fourteen when he composed his tragedy entitled Il Giustino; in which he appears too close and scrupulous an imitator of the Grecian drama. He lost his patron in 1717; who left him his heir, 'as being a young man of the most promising abilities.' Metastasio, at the age of nineteen, being, by this inheritance, superior to those wants which repress the exertions of genius, and to which men of abilities are too often subject, gave full scope to his inclination for poetry. He began his dramatic career with the Didonne Abandonnata, which was acted at Naples in 1724; the music composed by Sarro. He soon acquired such celebrity, that, in 1729, he was invited to Vienna by Charles VI.; who appointed him imperial poet, with a pension of 4000 florins. From that time some of his works were presented at every court festival. The courts of Vienna and Madrid vied with each other in the presents which they conferred upon him. This favorite of kings and of the muses was of a cheerful temper, and was exceedingly temperate; to this he was probably indebted for uninterrupted health and the entire possession of his senses to old age. He was also extremely regular in his diet, sleep, &c. He had even his stated hours for versification; to which he scrupulously adhered, without waiting for the moment of poetical enthusiasm. He was attacked by a fever on the 2d of April, 1782, and died on the 12th, aged eighty-four.' He left about 150,000 florins. He composed a great number of tragic operas, and several small dramatic pieces which have been set to music. Editions of them were printed in 4to. 8vo. and 12mo.; and M. Richelet published a translation of them into French, in 12 vols. 12mo.

METATAR'SUS, *n. s.* }
METATAR'SAL, *adj.* } Gr. μέτα and ταρσός, the TARSUS, which see. The middle of the foot; belonging to this part of the foot.

The conjunction is called synarthrosis, as in the joining the tarsus to the *metatarsus*. *Wiseman.*

The bones of the toes, and part only of the *metatarsal* bones, may be carious; in which case cut off only so much of the foot as is disordered. *Sharp's Surgery.*

METATARSUS. See ANATOMY.

METARO, a river of Italy, in the marquisate of Ancona, which runs into the Adriatic near Ancona. It gave name to one of the eight departments into which the Papal dominions were divided, when they were revolutionised in March 1798, by the French, and erected into the short-lived Roman republic.

METATHE'SIS. Gr. μεταθεσις, of μετα, trans, and θεσις, position. Transposition; a grammatical figure, whereby letters or syllables of a word are transposed, or shifted from their natural situation. Metathesis is also used by medical writers for a change of place in such humors, or other diseased parts, as cannot be absolutely removed or sent off. Thus a metathesis of a cataract is a depression, so that it no longer shuts out the light.

METE, *v. a.* }
ME'TER, *n. s.* }
METE'WAND, }
METE'YARD. } Sax. mæthan; Goth. and Swed. *meta*; Belg. *meten*; Lat. *metior*; Gr. μετρέω; Heb. מדד. To measure; reduce to measure; give out or apportion by measure: a meter is a measurer: mete-wand and mete yard, instruments of measurement.

Ye shall do no unrighteousness in meteyard, weight, or measure. *Lev.* xix. 35.

I will divide Shechem, and *mete* out the valley of Succoth. *Psalms.*

With what measure ye *mete*, it shall be measured to you again. *Matt.* vii. 2.

A true touchstone, a sure *metewand*, lieth before their eyes. *Ascham's Schoolmaster.*

Though you many ways pursue
To find their length, you'll never *mete* the true.
But thus; take all that space the sun
Metes out, when every daily round is run. *Creech.*

To measure any distance by a line, apply some known measure wherewith to *mete* it. *Holder.*

METELLUS, the surname of the family of the Cæcilii at Rome, the most celebrated of whom were, 1. A general who defeated the Achæans, took Thebes, and invaded Macedonia, &c. 2. Q. Cæcilius, who rendered himself illustrious by his successes against Jugurtha, king of Numidia, from which he was surnamed Numidicus. 3. Q. Cæcilius, who was pontifex maximus, and saved from the flames the palladium, when Vesta's temple was on fire. He lost his sight and one of his arms in the action; and the senate, to reward his zeal and piety, permitted him always to be drawn to the senate-house in a chariot, an honor which no one had ever before enjoyed. He also gained a great victory over the Carthaginians. 4. Q. Cæcilius Celer, who distinguished himself by his spirited exertions against Catiline. He married the sister of Clodius, who disgraced herself by her lasciviousness. He died A. A. C. 57. He was greatly lamented by Cicero, as one of the most faithful and valuable friends. 5. L. Cæcilius, a tribune in the civil wars of Cæsar and Pompey. He favored the cause of Pompey, and opposed Cæsar when he entered Rome with a victorious army. He refused to open the gates of Saturn's temple, in which were deposited great treasures; upon which they were broken open by Cæsar, and Metellus retired. 6. Q. Cæcilius, a warlike general, who conquered Crete and Macedonia, and was surnamed Macedonicus. 7-10. He had four sons, of whom three were consuls, and the other obtained a triumph, all during their father's lifetime. Cimber, a conspirator against Cæsar, who gave the signal to murder him in the senate-house.

METEMPSYCHO'SIS, *n. s.* } Gr. μετεμψύχωσις, The
METEMPSYCHOSE', *v. a.* } transmigration of souls from body to body. See below.

The souls of usurers after their death, Lucian affirms to be *metempsychosed*, or translated into the bodies of asses, and there remain certain years, for poor men to take their pennyworth out of their bones.
Peacham on Blazoning.

From the opinion of *metempsychosis*, or transmigration of the souls of men into the bodies of beasts, most suitable unto their human condition, after his death Orpheus the musician became a swan.
Browne's Vulgar Errours.

METEMPSYCHOSIS is formed of μετα, beyond and εμψυχω, I animate. Pythagoras and his followers held, that after death men's souls passed into other bodies, of this or that kind, according to the life they had led. If they had been vicious, they were imprisoned in the bodies of miserable beasts, there to do penance for several ages; at the expiration whereof they returned again to animate men. But, if they lived virtuously, some happier brute, or a human creature, was to be their lot. Pythagoras is said by some to have borrowed the notion of a metempsychosis from the Egyptians; by others from the ancient Brachmans. It is still retained among the idolaters of India and China; and makes the principal foundation of their religion. So extremely are they bigoted to it, that they not only forbear eating any thing that has life, but many of them even refuse to defend themselves from wild beasts. They burn no wood, lest some little animalcule should be in it; and will redeem from the hands of strangers any animals that they find ready to be kiiled. See PYTHAGORAS.

METEMPTOSIS, from μετα, after, and πιπτω, I fall, a term in chronology, expressing the solar equation necessary to prevent the new moon from happening a day too late; by which it stands contradistinguished from Proemptosis, which signifies the lunar equation necessary to prevent the new moon from happening too soon. The new moon's running a little backwards, that is, coming a day too soon at the end of 312 years and a half; by the proemptosis, a day is added every 300 years, and another every 2400 years: on the other hand, by the metemptosis, a bissextile is suppressed each 134 years; that is, three times in 400 years. These alterations are never made but at the end of each century; that period rendering the practice of the calendar easy. There are three rules for making this addition or suppression of the bissextile day, and for changing the index of the epacts. 1. When there is a metemptosis without a proemptosis, the next following, or lower index, must be taken. 2. When there is a proemptosis without a metemptosis, the next preceding or superior index is to be taken. 3. When there are both a metemptosis and a proemptosis, or when there is neither the one nor the other, the same index is preferred. Thus, in 1600, we had D: in 1700, by reason of the metemptosis, C was taken: in 1800 there were both a proemptosis and metemptosis; so the same index was retained. In 1900 there will be a metemptosis again, when B will be taken; which will be preserved in 2000, because there will then be neither the one nor the other. This is as far as we need to compute for it: but Clavius has calculated a cycle of 301,800 years; at the end of which period the same indices return in the same order. See EPACT

METEOROLOGY.

METEOR, *n. s.* } Fr. *meteore*; Gr.
METEOR'ICAL, *adj.* } μετεωρα, à μετεωρος,
METEOROLOG'ICAL, } high. Any light and
METEOROL'OGIST, *n. s.* } fleeting aërial body; a
METEOROL'OGY, } luminous body of this
METE'OROUS, *adj.* } kind: meteorical, resembling a meteor: meteorological is, relating to the doctrine of meteors: a meteorologist, he who studies or is a proficient in that doctrine: meteorology, the science which treats of it, see below: meteorous is, having the nature of a meteor.

Looked he or red, or pale, or sad, or merrily?
What observation madest thou in this case,
Of his heart's *meteors* tilting in his face?
Shakspeare.

She began to cast with herself from what coast this blazing star must rise upon the horizon of Ireland; for there had the like *meteor* strong influence before.
Bacon's Henry VII.

These burning fits but *meteors* be,
Whose matter in thee soon is spent:
Thy beauty, and all parts which are in thee,
Are an unchangeable firmament. *Donne.*

It is no otherwise in the firmament of the church: how many have there been, that have seemed eternally fixed in that high sphere, which have proved no other than base *meteors*, gilded with fair beams! they appeared stars; their substance was but slime. *Bp. Hall.*

In a third, I see a resemblance of that *meteorical* light, which appears in moorish places, that seems fire, but is nothing but a slimy glittering exhalation. *Id.*

The *meteorologists* observe, that, amongst the four elements which are the ingredients of all sublunary creatures, there is a notable correspondency. *Howel's Vocal Forest.*

From o'er the hill
To their first station, all in bright array,
The cherubim descended, on the ground
Gliding *meteorous*, as evening mist
Risen from a river. *Milton's Paradise Lost.*

In animals we deny not a natural *meteorology*, or innate presentation of wind and weather. *Browne.*

Others are considerable in *meteorological* divinity. *Id.*

Why was I raised the *meteor* of the world,
Hung in the skies, and blazing as I travelled,
Till all my fires were spent; and then cast downward
To be trod out by Cæsar? *Dryden. All for Love.*

O poet, thou hadst been discreeter,
Hanging the monarch's hat so high,
If thou hadst dubbed thy star a *meteor*,
Which did but blaze, and rove, and die. *Prior.*

METEOROLOGY, from Gr. *μετεωρος*, high; or rather from *μετα*, denoting change of place, and *αειρω*, to lift up (it is worth remarking also that *μετεωροι* is often used by the Greek writers, both sacred and profane, to signify being agitated or tossed about, as a ship at sea), is that science which professes to treat of the general phenomena of the atmosphere; and has by some writers been considered as embracing its entire composition, changes, and appearances. Particular classes of those appearances which strike the eye were long emphatically called *meteors*, Gr. *μετεωρα*, Lat. *impressiones*, as making signs or impressions on the air; and gave their name to the whole doctrine of aërial phenomena, which has hence been treated as one and the same throughout. It is quite evident that we might as reasonably suppose every doctrine that can be expressed or impressed upon paper as one and the same.

This is therefore one of those terms of science, having their origin partly in the observations and apprehensions of the vulgar, and partly in the too early attempt to generalise that marks a particular stage in the progress of all the sciences, which it is the tendency of experiment and of a maturer state of knowledge to explode. Certainly there is *no science* of meteorology if there be any distinction worth retaining in the sciences; and if some of the most brilliant discoveries of modern science are worth any thing: what has been often thus denominated has been demonstrated to belong to ELECTRICITY, to MAGNETISM, or ELECTRO-MAGNETISM, in great part; and still more to CHEMISTRY, to COMBUSTION, to OPTICS or to PNEUMATICS; to the laws of VISION, or to the doctrine of LIGHT and HEAT. It is impossible indeed to treat of these topics scientifically, without exhibiting the causes and laws of almost every phenomenon which meteorology has been thought to include; and it will eventually, we have no doubt, be felt as absurd to look for an account of these widely different operations of nature under such a general head, because they appear in or through the medium of the atmosphere, as under the article ASTRONOMY itself, because a large portion of them have been long termed 'falling stars.'

Yet the history of what has been called meteorology has some points of great interest about it; and like alchemy and judicial astrology it will be found to have led forward some noble spirits to distinguished and most important attainments in science. For this reason we shall give a brief historical account of its progress, and present state; the best modern instruments employed in meteorological observations; and a list of the singular productions called meteorolites, or meteoric stones.

SECT. I. PROGRESS OF OPINION ON THE COMPOSITION OF THE ATMOSPHERE.

1. The *atmosphere* was so denominated by the Greeks (*ατμος*, a vapor, and *σφαιρα*) from the quantity of vapor combined in it. Aristotle, it is well known, considered it a species of element occupying a middle place between fire and water: mingled with dry exhalations he states it to produce thunder, lightning, and wind; and with moist exhalations, rain, snow, and hail. The ancients seem to have had a general belief that atmospheric air was a constituent principle of other bodies, and that they were mutually convertible into each other: thus Lucretius, as translated by Good, says

All that pours profuse
From things, perpetual, the vast ocean joins
Of air sublime; which if to things again
Paid not, thus balancing the loss sustained,
All into air would dissipate and die.
Hence, born from things, to things air still returns
Ceaseless, as prove their fluctuating forms.

To the physical properties of the atmosphere, however, the actual observations of the ancients were confined: its chemical and mechanical properties cannot be said to have been the subjects of experiment until the beginning of the seventeenth century. Galileo led the way by pointing out its weight, a subject to which Torricelli and Pascal directed their attention: its density and elasticity were ascertained by the Florentine academicians, and still more accurately by Mr. Boyle, who fully demonstrated its essential connexion with combustion, the wants of animal life, &c. Together with Hooke, Newton, and Durham, he also considered its relation t sound, to light, and to electricity. Sir Isaac Newton explained the effect produced upon it by moisture; and on this foundation Halley began to explain the ehanges in its weight as indicated by the barometer. But the former had some curious opinions as to the origin of the atmosphere: as he supposed the planets generally, to

be influenced by comets; so from the tails of the latter he thought that some of the finer parts of our atmosphere were produced. He even supposed, that from these bodies a quantity of water, imagined to be wasted in the various operations of nature, might be supplied.

Mr. Boyle, and his contemporaries, put it beyond doubt that the atmosphere contained two distinct substances. 1. An elastic fluid distinguished by the name of air. 2. Water in a state of vapor. Besides these two bodies, it was supposed that the atmosphere contained a great variety of other substances, which were continually mixing with it from the earth, and which often altered its properties, and rendered it noxious or fatal. But to Mayow, in particular, who succeeded Boyle, we may certainly trace the nucleus of all the great modern discoveries in the analysis of atmospheric air. He rejected the use of the air-pump, and made choice of glass jars, inverted in water, as the best method of confining gases. From the facts discovered by Boyle, he argues, that, since a lighted candle is extinguished much sooner in an exhausted receiver than in the same when filled with air, there must be something contained in the atmosphere necessary to the continuance of flame; and that a candle, in confined air, is not suffocated by its own fuliginous exhalations, but dies away for want of an aërial pabulum. The necessity of air to combustion is proved, says he, from the impossibility of kindling a combustible body in vacuo by the concentrated solar rays, or by any other method. Having established this position, he proceeds to infer that it is not the whole air but only its more active particles, that are capable of supporting flame, because a candle goes out in confined air, while yet the greatest part of the electric fluid remains unconsumed. Also, since sulphur, when mixed with nitre, becomes capable of inflammation in vacuo, or even under water, it follows that nitre and atmospherical air contain some substance in common, which he calls fire-air particles (particulæ igneo-aereæ). He next determined the analogy between flame and animal life; and showed, that each depended for their continuance on a supply of fire-air particles: that there was an actual consumption of air in combustion and respiration he proved, by the rise of water in the jars in which a live animal or a lighted candle was enclosed; and that the loss of bulk was owing to the abstraction of fire-air, appeared from the inability of the residue to support animal life. He inferred, also, that the fire-air particles were the heaviest part of atmospheric air, because, if two mice or two candles were confined in a tall cylindrical jar, inverted in water, so as that one should be near the upper part of the vessel, and the other at the bottom, the upper one, whether a candle or animal, would be extinguished some time before the lower one. With regard to the proportion of fire-air in the atmosphere, he only observed, that air rendered unfit for combustion by the breathing of an animal, lost about one-fourteenth of its bulk; at the same time remarking, that there was probably only a part of the fire-air consumed: he afterwards, indeed, found that the solution of iron in aquafortis occasioned a diminution of about 25 per cent. in atmospheric air; but though, in this case he produced nitrous gas, and thus abstracted the oxygen of the atmosphere, yet, as he himself draws no conclusions from it, we should rather consider this as an accident than a discovery. Mayow never obtained the fire-air of the atmosphere in a separate state, and therefore was unable to confirm his analysis of atmospheric air by the synthetical proof; nevertheless, he was warranted by a very high probability in affirming that the atmosphere consisted of two kinds of air, of which the igneo-aerial was in the proportion of at least one to thirteen; that it exceeded the other part in its specific gravity, and was absolutely essential to the continuance of flame and animal life. The influence, however, of the prevalent hypothesis was at that time too strong to be shaken by sober experiment; and the labors and very name of Mayow shortly sunk into oblivion, until in 1744 Dr. Priestley's discovery of what he called dephlogisticated air, accidentally revived them.

Next follow Hales, Black, Priestley, Scheele, and Lavoisier, in this department of science; but we have already detailed their labors in the article Air. The 'foul air' of Scheele is the phlogisticated air of Dr. Priestley and the azotic gas of the modern nomenclature. His empyreal air is the same with the dephlogisticated air of Priestley, or the modern oxygen gas.

Lavoisier, while Scheele was occupied with his experiments, was assiduously employed on the same subject, and was led by a different road to precisely the same conclusion. By oxidising mercury in a vessel filled with common air, and heated to the boiling point of mercury, he abstracted the greater part of its oxygen gas; and, by heating the red oxide formed, he reconverted it into mercury, and extricated a quantity of oxygen. The residuum in the first experiment possessed the properties of azotic gas; but, when the oxygen gas extricated from the mercury was added to it, the mixture assumed again the properties of common air. Hence he concluded that air is composed of azotic gas and oxygen; and from a variety of experiments he determined the proportions to be seventy-three parts of azotic gas and twenty-seven parts of oxygen gas. He stated, too, that when air is diminished by liquid sulphurets, metals, &c., the oxygen gas which is abstracted combines with the sulphurets, &c., and converts them into acids or oxides according to their respective nature.

The general composition of the atmosphere having thus become known, it became important to determine the relative quantity of oxygen in a given portion of air, which gave rise to the invention of the Eudiometer. See our article of that name.

Mr. Cavendish first brought the eudiometer to such a state of precision as to be enabled to ascertain correctly the constituents of air. His method was to put 125 measures of nitrous gas into a glass vessel, and to let up into it very slowly 100 measures of the air to be examined, agitating the vessel containing the nitrous gas during the whole time. The diminution of bulk when the process was conducted in this way was

almost uniform. The greatest was 110, the least 106·8; the mean 108·2. The variation he found to depend, not upon the air examined, but upon the state of the water in which the experiment was made. If this experiment was reversed, by letting up the nitrous gas to common air, he used 100 measures of each, and the diminution in that case was only ninety measures. This regular diminution of the bulk of all the different specimens of common air examined, induced Mr. Cavendish to conclude that the proportion between the oxygen and azote in common air does not vary. To find the absolute quantity of oxygen in air, he mixed together oxygen gas and azote in various proportions, and at last found that a mixture of ten measures of the purest oxygen which he could procure with thirty-eight measures of azote, was just as much diminished by the nitrous gas as the same bulk of common air. Hence he concluded that air is composed of ten parts by bulk of oxygen and thirty-eight of azote, which gives us for its composition per cent.

79·16 azote.
20·84 oxygen

100·00

or very nearly twenty-one per cent. of oxygen gas (Philosophical Transanctions, 1808, p. 107). Other philosophers, who did not pay Mr. Cavendish's rigid attention to precision, obtained variable results from the nitrous gas eudiometer. Most of the circumstances which occasion the variation were pointed out by Cavendish; but they seem to have escaped the observation of succeeding chemists.

Humboldt's attempt to render the eudiometer of Fontana accurate did not succeed; but Mr. Dalton explained the anomalies in a very luminous manner. According to this philosopher, oxygen gas and nitrous gas are capable of uniting in two proportions: twenty-one measures of oxygen gas uniting either with thirty-six measures of nitrous gas, or with twice 36, = 72 measures, and both of these compounds are soluble in water. If the tube be wide, a considerable portion of nitrous gas comes at once in contact with the oxygen. Hence the latter gas combines with a maximum of nitrous, especially if agitation be employed. In a narrow tube the oxygen combines with the minimum of nitrous gas, provided no agitation be employed, and the residue be poured soon into another vessel. When intermediate proportions are used, the absorption will be immediate. Mr. Dalton recommends a narrow tube; the nitrous gas is only to be in the proportion requisite to form the minimum combination; no agitation is to be employed: and, when the diminution is completed, the gas must be transferred to another tube. To 100 measures of air add about thirty-six of nitrous gas; note the diminution of bulk, and multiply it by seven-nineteenths; the product gives the bulk of oxygen in the air examined.

In order to get rid of the anomalies which had perplexed former experimenters, Sir Humphry Davy proposed to employ the nitrous gas in a different state. He caused sulphate or muriate of iron to absorb this gas to saturation, and employed the dark brown liquid thus obtained to deprive air of its oxygen. A small graduated glass tube, filled with the air to be examined, is plunged into the nitrous solution, and moved a little backwards and forwards. The whole of the oxygen is absorbed in a few minutes The state of greatest absorption ought to be marked, as the mixture afterwards emits a little gas, which would alter the result. By means of this Sir Humphry examined the air at Bristol, and found it always to contain about 0·21 of oxygen. Air sent to Dr. Beddoes from the coast of Guinea gave exactly the same result.

It appears, whatever are the varieties of this and other instruments employed, that the result is pretty uniform: they all indicate that common air consists very nearly of twenty-one parts of oxygen, and seventy-nine of azote. Gay Lussac examined air brought from the height of more than 21,000 feet above Paris, and found it precisely the same as the air at the earth's surface.

'But twenty-one cubic inches of oxygen gas,' says Dr. Thomson, 'weigh 9·14 grains, and seventy-nine inches of azote weigh 23·9686 grains; these added together amount to 31·1086 grains; which ought to be the weight of 100 inches of common air. But this is somewhat greater than the weight of 100 inches of air, according to Sir John Shuckburgh Evelyn's experiment, who found it only 31·0127 grains. The difference, however, is not great, and is probably owing to a small error in the specific gravities of the different gases. According to this estimate, 100 parts of air are composed by weight of

22·91 oxygen
77·09 azote

100·00

2. *Of the aqueous parts of the atmosphere.*—Dr. Hooke, and afterwards Dr. Halley, conceived that water may be dissolved in air in the manner that salt is held in solution by water. M. Le Roy endeavoured to confirm this in 1751, and about the same time Dr. Hamilton of Dublin espoused the same theory. Deluc afterwards suggested, that water more probably and generally exists in air in the state of vapor. But we are indebted to Mr. Dalton for the first information on the subject that can be called precise. In the Manchester Memoirs, v. p. 517, he thus states his opinions:—

(1.) It cannot be doubted, he contends, that the water which exists in air, is derived originally from the waters on the surface of the earth, which are exposed to the action of the atmosphere. Accordingly we find that water, when exposed to the air, suffers a gradual diminution of bulk, and at last disappears altogether. This diminution of the water may be owing, either to its gradual solution in air, or to its conversion into vapor. The last is the common opinion, as the phenomenon is in common language ascribed to the evaporation of the water. When water is placed in an exhausted receiver, it diminishes in bulk even more rapidly than in the open air. In this case, as no air is present, we can only ascribe the diminution

of bulk to the conversion of the water into vapor. Accordingly we find, upon examination, that the receiver is actually filled with water in the state of vapor. The presence of this vapor very soon, by its elasticity, puts an end to the evaporation of the water. Now, since water disappears equally whether air be present or not, and exactly in the same manner, it is reasonable to ascribe its disappearing in both cases to the same cause. But in the exhausted receiver it is converted into vapor. Hence it is probable that it is converted into vapor also in the open air; and, if so, it must exist in air in the state of vapor.

(2.) If the disappearing of water exposed to the open air were owing to solution, and not to evaporation, it ought certainly to disappear more rapidly when it is exposed to the action of a great quantity of air than when to a small quantity; for the quantity of any body dissolved is always proportional to the quantity of the solvent. But the very contrary is what actually takes place with respect to the water contained in the air. Saussure has proved that water evaporates much faster at great heights than at the surface of the earth, even when the temperature and the moisture of the air in both places are the same. By comparing a set of experiments made upon the Col-du-Geant, at the height of 11,275 feet above the level of the sea, with a similar set made at Geneva, 1324 feet above the level of the sea, he ascertained, that, supposing the temperature and the dryness of the air in both places the same, the quantity of water evaporated at Geneva is to that evaporated on the Col-du-Geant in the same time and same circumctances as 37 to 84, or nearly as 3 : 7. Now the air on the Col-du-Geant is about one-third rarer than at Geneva; so that the diminution of about one-third in the density of the air more than doubles the rate of evaporation. This is precisely what ought to be the case, provided the water which disappears mixes with the air in the state of vapor only; but the very contrary ought to hold, if the water disappeared in consequence of a solvent power in the air.

(3.) It has been demonstrated by Dr. Black, that vapor is water combined with a certain dose of caloric. Consequently, when water is converted into vapor, a certain portion of caloric combines with it and disappears. If, therefore, there is the same waste of caloric whenever water passes from a liquid state, and enters into the atmosphere as a component part, we have reason to conclude that it enters into the atmosphere only in the state of vapor. But it is a well-known fact, that cold is always generated during spontaneous evaporation; that is to say, that the water as it disappears carries off with it a quantity of caloric. It is well known that, when a wet body is exposed to the air, its temperature is lowered by the evaporation which takes place upon its surface. Hence, in warm countries, water is cooled by putting it into porous vessels, and exposing it to the air. The water penetrates through the vessels, evaporates from their surface, and carries off so much heat, as even in some cases to freeze the water in the vessel. Saussure observed, that the evaporation from the surface of melted snow caused it to freeze again when the temperature of the surrounding air was 4·5° above the freezing point. Dr. Black has rendered it probable that the quantity of caloric which disappears during spontaneous evaporation is as great as that which is necessary to convert water into steam. We have a right then to conclude that water, when it evaporates spontaneously, is always converted into vapor, which of course is only in that state that it enters into the atmosphere.

(4.) Mr. Dalton has demonstrated that the water which exists in air possesses precisely the same degree of elasticity that it does when in the state of a vapor in a vacuum at the same temperature. Hence it follows irresistibly that it exists in air, not in the state of water, but of an elastic fluid or vapor. We are authorised to conclude, then, that the water which exists in the atmosphere is in the state of vapor. This vapor is held in solution by the air precisely as one species of gas is by another. Hence the reason why it is so difficult to separate it, and why it is capable of undergoing a considerable degree of compression without assuming the form of a liquid.

Various attempts have been made to measure the quantity of water contained in air; but Saussure was the first who attained any thing like precision. This philosopher states, in his Hygrometrical Essays, that an English cubic foot of air, when saturated with water at the temperature of 66°, contains only about eight grains troy of that liquid, or about one-sixty-seventh of its weight. But the experiment of Mr. Dalton was susceptible of more precision. As the greatest part of the water of the atmosphere is in the state of vapor, the elasticity of which depends upon the temperature, it is obvious that this elasticity, provided it can be ascertained, must measure the quantity of vapor which exists in the atmosphere, the temperature being the same. The elasticity or force of vapor, was determined by this ingenious philosopher in the following manner, which had been originally contrived by Le Roy: he took a tall cylindrical glass jar, dry on the outside, and filled it with cold spring water fresh from the well: if dew was immediately formed on the outside, he poured the water out, let it stand the while to increase in temperature, dried the outside of the glass well with a linen cloth, and then poured the water in again. This operation was to be continued till the dew ceased to be formed, and then the temperature of the water was observed; and opposite to it in the table was found the force of vapor in the atmosphere. This experiment must be conducted in the open air, or at a window; because the air within is generally more humid than that without. Spring water is generally about 50°, and will mostly answer the purpose of the three hottest months in the year: in other seasons an artificial cold mixture is required. From Dalton's experiments it followed that the quantity of vapor in the atmosphere is variable in quantity. In the torrid zone its force seems to vary from 0·6 to one inch of mercury. In Britain it seldom amounts to 0·6, but is often as

great as 0·5 during summer. In winter it is often as low as 0·1 of an inch of mercury. Mr. Dalton supposes that the medium quantity of vapor held in solution at once in the atmosphere may amount to about one-seventieth of its bulk.

3. *Of the carbonic acid gas of the atmosphere.*—The existence of carbonic acid gas, as a constituent of the atmosphere, was observed by Dr. Black immediately after he had ascertained the nature of that fluid.

'If we expose,' says Dr. Thomson, 'a pure alkali or alkaline earth to the atmosphere, it is gradually converted into a carbonate by the absorption of carbonic acid gas. This fact, which had been long known, rendered the inference, that carbonic acid gas existed in the atmosphere, unavoidable, as soon as the difference between a pure alkali and its carbonate had been ascertained to depend upon that acid. Not only alkalies and alkaline earths absorb carbonic acid when exposed to the air, but several of the metallic oxides also. Hence the reason that we so often find the native oxides in the state of carbonates. Thus rust is always saturated with carbonic acid.

'Carbonic acid gas not only forms a constituent part of the atmosphere near the surface of the earth, but at the greatest heights which the industry of man has been able to penetrate. Saussure found it at the top of Mont Blanc, the highest point of the old continent; a point covered with eternal snow, and not exposed to the influence of vegetables or animals. Lime-water, diluted with its own weight of distilled water, formed a pellicle on its surface after an hour and three quarters exposure to the open air on that mountain; and slips of paper, moistened with pure potash, acquired the property of effervescing with acids after being exposed an hour and a half in the same place. Now this was at a height no less than 15,668 feet above the level of the sea. Humboldt has more lately ascertained the existence of this gas in air brought by Mr. Garnerin from a height not less than 4280 feet above the surface of the earth, to which height he had risen in an air-balloon. This fact is a sufficient proof that the presence of carbonic acid in air does not depend upon the vicinity of the earth. The difficulty of separating this gas from air has rendered it difficult to determine, with accuracy, the relative quantity of it in a given bulk of air. From the experiments of Humboldt, it appears to vary from 0·005 to 0·01.'

Dalton's experiments give a much smaller quantity. He found, that if a glass vessel filled with 102,400 grains of rain water be emptied in the open air, 125 grains of lime water be poured in, and the mouth then closed; by sufficient time and agitation the whole of the lime-water is just saturated with the carbonic acid which it finds in the enclosed volume of air: but 125 measures of lime-water require seventy measures of carbonic acid gas to saturate them. Hence he concludes that air contains only $\frac{1}{1400}$th of its bulk of carbonic acid. From the experiments of Mr. Cavendish, however, we learn that lime-water is not capable of entirely depriving air of its carbonic acid. A portion still remains, which can only be separated either by milk of lime, or by repeated washings with new doses of lime-water. Hence the quantity of carbonic acid in air must be greater than it was found by Mr. Dalton. The three great component parts of the atmosphere are thus exhibited by Mr. Thomson:—

98·9 air.
1·0 vapor.
0·1 carbonic acid.

This last writer notices, in addition, the presence of what he calls 'unknown bodies' in the atmosphere, or respecting which very little satisfactory is known, as we are not in possession of instruments sufficiently delicate to ascertain their presence. We can indeed detect several of them actually mixing with the air, but what becomes of them afterwards we are not able to say. Dr. Thomson thus enumerates them:—1. Hydrogen gas is said to have been found in air situated near the crater of volcanoes, and it is very possible that it may exist always in a very small proportion in the atmosphere. From the experiments of Gay Lussac and Humboldt, it appears that air does not contain so much as $\frac{1}{1000}$th parts of hydrogen. 2. Carbureted hydrogen gas is often emitted by marshes in considerable quantities during hot weather. But its presence has never been detected in air; so that in all probability it is again decomposed by some unknown process. 3. Oxygen gas is emitted by plants during the day. We shall find reason to conclude that this is in consequence of the property which plants have of absorbing and decomposing carbonic acid gas. Now, as this carbonic acid is formed at the expense of the oxygen of the atmosphere, as this oxygen is again restored to the air by the decomposition of the acid, and as the nature of atmospheric air remains unaltered, it is clear that there must be an equilibrium between these two processes; that is to say, all the carbonic acid formed by combustion must be again decomposed, and all the oxygen abstracted must be again restored. The oxygen gas, which is thus continually returning to the air, keeps its component parts always at the same ratio. 4. The smoke and other bodies which are continually carried into the air by evaporation, &c., are probably soon deposited again, and cannot, therefore, be considered, with propriety, as forming parts of the atmosphere

'But there is another set of bodies which are occasionally combined with air, and which, on account of the powerful action which they produce on the human body, have attracted a great deal of attention. These are sometimes known by the name of matters of contagion. That there is a difference between the atmosphere in different places, as far as respects its effects upon the human body, has been considered as an established point in all ages. Hence some places have been celebrated as healthy, and others avoided as pernicious to the human constitution. It is well known that in pits and mines the air is in such a state as to suffocate, almost instantaneously, those who attempt to breathe in it. Some places are haunted by peculiar diseases. It is known that those who frequent the apartments of persons ill of certain maladies are extremely

apt to catch the infection; and in prisons, and other places where crowds of people are confined together, when diseases once commence, they are wont to make dreadful havoc. In all these cases it has been supposed that a certain noxious matter is dissolved by the air, and that it is the action of this matter which produces the mischief. This noxious matter is in many cases readily distinguished by the peculiarly disagreeable smell which it communicates to the air. No doubt this matter differs according to the diseases which it communicates, and the substance from which it has originated.'

Morveau, on attempting to ascertain its nature, found the chemical tests hitherto discovered altogether insufficient for that purpose. 'He has put it beyond a doubt, however,' says Dr. Thomson, 'that the noxious matter which rises from putrid bodies is of a compound nature; and that it is destroyed together by certain agents, particularly by those gaseous bodies which readily part with their oxygen. He exposed air infected by putrid bodies to the action of various substances; and he judged of the result by the effect which these bodies had in destroying the fetid smell of the air. The following is the result of his experiments:—1. Odorous bodies, such as benzoin, aromatic plants, &c., have no effect whatever. 2. Neither have the solutions of myrrh, benzoin, &c., in alcohol, though agitated in infected air. 3. Pyroligneous acid is equally inert. 4. Gunpowder, when fired in infected air, displaces a portion of it; but what remains still retains its fetid odor. 5. Sulphuric acid has no effect; sulphureous acid weakens the odor, but does not destroy it. 6. Vinegar diminishes the odor, but its action is slow and incomplete. 7. Acetic acid acts instantly, and destroys the fetid odor of infected air completely. 8. The fumes of nitric acid, first employed by Dr. Carmichael Smith, are equally efficacious. 9. Muriatic acid gas, first pointed out as a proper agent by Morveau himself, is equally effectual. 10. But the most powerful agent is oxymuriate acid gas (chlorine), first proposed by Mr. Cruikshanks, and now employed with the greatest success in the British navy and military hospitals.'

For the more modern opinions upon the subject of the composition of the atmosphere, the reader is referred to the article AIR.

SECT. II.—OF THE WEIGHT AND PRESSURE OF THE ATMOSPHERE.

Meteorology has been largely conversant with the weight and pressure, or elasticity, of the atmosphere. It appears to be a general law of elastic fluids, that their pressure on any given surface is diminished as their bulk is increased. If, therefore, the column of mercury in the vacuum of an air-pump were sixty inches high, the air would be reduced to half its natural bulk; and, for the same reason, the pressure of a column of thirty inches of mercury in the open air will reduce any portion of air to half its bulk, since the natural pressure of the atmosphere, which is equal to that of about thirty inches of mercury, is doubled by the addition of an equal pressure. In this manner the density of the air in a diving-bell is doubled at the depth of thirty-four feet below the surface of the water, and tripled at the depth of sixty-eight feet. This law was discovered by Dr. Hooke; he found, however, that when a very great pressure had been applied, so that the density became many times greater than in the natural state, the elasticity appeared to be somewhat less increased than the density.

Not only the common air of the atmosphere but also steams and vapors of all kinds, appear to be equally subject to this law: they must, however, be examined at temperatures sufficient to preserve them in a state of elasticity; for example, if we wished to determine the force of steam twice as dense as that which is usually produced, we should be obliged to employ a heat 30° or 40° above that of boiling water: we should then find that steam of such a density as to support, when confined in a dry vessel, the pressure of a column of thirty inches of mercury, would be reduced to half its bulk by the pressure of a column of sixty inches. But, if we increase the pressure much beyond this, the steam would be converted into water.

That the air of the atmosphere possesses weight, may be shown by weighing a vessel which has been exhausted by the air-pump, and weighing it a second time after allowing the air to enter. In this manner we also ascertain its specific gravity, even if the exhaustion is only partial, provided that we know the proportion of the air left in the vessel to that which it originally contained. The pressure derived from the weight of the air is also the cause of the ascent of hydrogen gas, or of any portion of air rarefied by heat; this effect is made conspicuous when either the hydrogen gas, or the heated air, is confined as in a balloon. The diminution of the apparent weight of a body, by means of the pressure of the surrounding air, is also shown by the destruction of the equilibrium between bodies of different densities, upon their removal into the vacuum of an air-pump.

This combination of weight and elasticity in the atmosphere, induces the supposition that its upper parts are much more rare than those which are near the earth, since the density is every where proportional to the whole of the superincumbent weight. The weight of a column of air one foot in height is $\frac{1}{28000}$th of the pressure; consequently that pressure is increased $\frac{1}{28000}$th by the addition of the weight of one foot, and the next foot will be denser in the same proportion, since the density is always proportionate to the pressure: the pressure thus increased will therefore still be equal to 28,000 times the weight of the next foot. The same reasoning may be continued without limit; and it may be shown, that while we suppose the height to vary by any uniform steps, as by distances of a foot or a mile, the pressures and densities will increase in continual proportion; thus, at the height of about 3000 fathoms, the density will be about half as great as at the earth's surface; at the height of 6000 one-fourth; at 9000 one-eighth as great. Hence it is inferred that the height in fathoms may be readily found from the logarithm of the number expressing the density of the air: for the logarithm of the number 2, multiplied by 10,000, is 3010, the logarithms of numbers always increasing

in continual proportion, when the numbers are taken larger and larger by equal steps. And thus we obtain an easy method of determining the heights of mountains: for if a bottle of air were closely stopped on the summit of a mountain, and, being brought in this state into the plain below, its mouth were inserted into a vessel of water or of mercury, a certain portion of the liquid would enter the bottle; this being weighed, if it were found to be one-half of the quantity that the whole bottle would contain, it might be concluded that the air on the mountain possessed only half of the natural density, or that its height was 3000 fathoms. Thus also it appears that the height of a column of equal density with any part of the atmosphere, equivalent to the pressure to which that part is subjected, is every where equal to about 28,000 feet. Various corrections, however, are necessary for ascertaining the heights of mountains with all the precision that the nature of this kind of measurement admits, involving a previous knowledge of the effects of heat, and of the nature of the ascent of vapors.

On the same principles we may ascertain the height to which a balloon will ascend, if we are acquainted with its bulk and weight: thus supposing its weight 500 lbs., and its bulk such as to enable it to raise 300 lbs. more, its specific gravity must be five-eighths as great as that of the air, and it will continue to rise until it reaches the height at which the air is of the same density: but the logarithm of eight-fifths multiplied by 10,000 is 2040; and this the number of fathoms contained in the height, which will, therefore, be a little more than two miles and a quarter. It may be found, by pursuing the calculation, that at the distance of the earth's semidiameter, or nearly 4000 miles above its surface, the air, if it exist, will become so rare, that a cubic inch would occupy a space equal to the sphere of Saturn's orbit: if, on the other hand, there were a mine forty-two miles deep, the air at the bottom would become as dense as quicksilver.

All bodies existing on or near the earth's surface, therefore, may be considered as subjected to the pressure of a column of air 28,000 feet high, supposing its density every where equal to that which it possesses at the earth's surface, and which is usually such, that 100 wine gallons weigh a pound avoirdupois, creating a pressure equal to that of thirty inches of mercury, or thirty-four feet of water, and which amounts to fourteen pounds and three quarters for each square inch. This pressure acts in all directions on every substance exposed to it: but, being counterbalanced by the natural elasticity of these substances, it produces in common no apparent effect. When, however, by any means the pressure of the air is removed from one side of a body, while it continues to act on the other, its operation becomes extremely evident. Thus, when two hollow hemispheres, in contact with each other, are exhausted of air, they are made to cohere with great force: Otto Guerike, of Magdeburg, constructed two such hemispheres, of sufficient magnitude to withstand the draught of the emperor's six coach horses, pulling with all their force to separate them. Hence they are sometimes called the Magdeburg hemispheres. By a similar pressure, a thin square bottle will, when it is sufficiently exhausted, be crushed, and a bladder may be torn with a loud noise: and the hand being placed on the mouth of a vessel connected with the air pump, it is fixed to it very forcibly, when the exhaustion is performed by the pressure of the air on the back of the hand; the fluids also, which circulate in the blood-vessels of the hand, are forced towards its lower surface, and the effect which is called suction is produced. On this principle cupping-glasses are made to act: partial exhaustion is procured by means of the flame of tow, which heats the air, expelling a great part of it; and the remainder, when it cools, becomes rarefied.

Galileo first explained the nature of suction from the effects of the pressure of the atmosphere; and Torricelli confirmed his doctrines by employing a column of mercury, of sufficient height to overcome the whole pressure of the atmosphere, and to produce a vacuum in the upper part of the tube containing it. In sucking up a fluid through a pipe, with the mouth or otherwise, the pressure of the air is but partially removed from the upper surface of the fluid, and it becomes capable of ascending to a height which is determined by the difference of the densities of the air within and without the cavity concerned; thus, an exhaustion of one-fourth of its air would enable us to raise water to the height of eight feet and a half, and mercury to seven inches and a half above the level of the reservoir from which it rises.

But when a tube of glass, about three feet long, closed at one end and open at the other, is filled with mercury, and them immersed in a basin of the same fluid, the pressure of the atmosphere is wholly removed from the upper surface of the mercury in the tube, while it continues to act on the mercury in the basin, and by its means on the lower surface of the column in the tube. If such a tube be placed under the receiver of an air-pump, the mercury will subside accordingly as the pressure of the atmosphere is diminished; and, if the exhaustion be rendered perfect, it will descend very nearly to the level of the open basin or reservoir. When the air is readmitted the mercury usually rises, on the level of the sea, to the height of about thirty inches; but, the air being lighter at some times than at others, varies between twenty-seven and thirty-one inches Such is the principle of the well-known instrument called the barometer. In order to observe the height of the mercury, with greater convenience and accuracy, the scale of this instrument has been amplified by various methods; by bending the upper part of the tube into an oblique position, as in the diagonal barometer; by making the lower part horizontal, and of much smaller diameter than the upper; or by making the tube straight, and narrow, and slightly conical; or by placing a float on the surface of the mercury in the reservoir, and causing an axis, which carries an index, to revolve by its motion. See our article Barometer. But a good simple barometer, about one-third of an inch in diameter, furnished with a vernier is perhaps full as accu-

rate as any of these more complicated instruments.

The method which is employed in determining the relation between the heights and densities of elastic fluids, may be extended to all bodies which are in any degree compressible, and of which the elasticity is subjected to laws similar to those which are discoverable in the air and other gases: it is even not improbable that these laws are generally applicable to all bodies, as far as their texture will allow them to submit to the operation of pressure. Water, for example, has been said by Canton to be compressible $\frac{1}{22000}$th of its bulk by a force equal to that of the pressure of the atmosphere; consequently this force may be represented by that of a column of water 750,000 feet in height; the density of the water at the bottom of a lake, or of the sea, will be increased by the pressure of the superincumbent fluid; and, supposing the law of compressure to resemble that of air, it may be inferred that, at the depth of 100 miles, its density would be doubled; and that at 200 it would be quadrupled. The same measures would also be applicable to the elasticity of mercury.

Sect. III.—The Temperature of the Atmosphere.

That the temperature of the air varies in different climates and seasons, as well as in the same place and in the same season, is sufficiently obvious. Nor can the cause of this perpetual variation be very simple: it cannot be the direct heat of the sun; for the rays of that luminary seem to produce no effect whatever upon air, though ever so much concentrated, although they warm the surface of the earth, which communicates its heat to the atmosphere: and hence it happens that the temperature of the air is highest in those places which are so situated as to be most warmed by the sun's rays, and that it varies in every region with the season of the year. Hence, too, the reason why it diminishes according to the height of the air above the earth. That portion of the earth, for instance, which lies at the equator, is exposed to the most perpendicular rays of the sun. Of course it is hottest, and the heat of the earth diminishes gradually from the equator to the poles. The temperature of the air must follow the same order. Yet, as in every place the temperature of the air is constantly varying with the season of the year, we cannot form any precise notion of the progression without taking the temperature in every degree of latitude for every day of the year, and forming for each a mean temperature for the whole year; which is done by adding together the whole observations, and dividing by their number. The quotient gives the mean temperature for the year. The diminution from the pole to the equator takes place in arithmetical progression: or, to speak more properly, the annual temperatures of all the latitudes are arithmetical means between the mean annual temperature of the equator and the pole. This was first discovered by Mr. Meyer; and by means of an equation which he founded on it, but rendered considerably plainer and simpler, Kirwan calculated the mean annual temperature of every degree of latitude between the equator and the pole. According to this calculation, that of the equator is 84°, and that of the pole 31°. To find the mean temperature, for every other latitude, we have only to find 88 arithmetical means between 84 and 31. In this manner Mr. Kirwan calculated the following table:—

Table of the Mean Annual Temperature of the Standard Situation in every Latitude.

Lat.	Temp.	Lat.	Temp.	Lat.	Temp.	Lat.	Temp.
90	31·	68	38·4	46	56·4	24	75·4
89	31·04	67	39·1	45	57·5	23	75·9
88	31·10	66	39·7	44	58·4	22	76·5
87	31·14	65	40·4	43	59·4	21	77·2
86	31·2	64	41·2	42	60·3	20	77·8
85	31·4	63	41·9	41	61·2	19	78·3
84	31·5	62	42·7	40	62·	18	78·9
83	31·7	61	43·5	39	63·	17	79·4
82	32·	60	44·3	38	63·9	16	79·9
81	32·2	59	45·09	37	64·8	15	80·4
80	32·6	58	45·8	36	65·7	14	80·8
79	32·9	57	46·7	35	66·6	13	81·3
78	33·2	56	47·5	34	67·4	12	81·7
77	33·7	55	48·4	33	68·3	11	82·
76	34·1	54	49·2	32	69·1	10	82·3
75	34·5	53	50·2	31	69·9	9	82·7
74	35·	52	51·1	30	70·7	8	82·9
73	35·5	51	52·4	29	71·5	7	83·2
72	36·	50	52·9	28	72·3	6	83·4
71	36·6	49	53·8	27	72·8	5	83·6
70	37·2	48	54·7	26	73·8	0	84·
69	37·8	47	55·6	25	74·5		

This table, however, only answers for the temperature of the atmosphere of the ocean. It was calculated for that part of the Atlantic Ocean which lies between 80° of N. and 45° of S. lat., and extends westward as far as the Gulf Stream, and to within a few leagues of the coast of America: and for all that part of the Pacific Ocean reaching from lat. 45° N. to lat. 40° S., from 20° to 275° of E. long. of London. This part of the ocean Mr. Kirwan calls the standard: the rest of the ocean is subject to anomalies which will be mentioned. Mr. Kirwan has also calculated the mean monthly temperature of the standard ocean. The principles on which he went were these:—The mean temperature of April seems to approach very nearly to the mean annual temperature; and, as far as heat depends on the action of the solar rays, the mean heat of every month is as the mean altitude of the sun, or rather as the sine of the sun's altitude. The mean heat of April, therefore, and the sine of the sun's altitude, being given, the mean heat of May is found in this manner: as the sine of the sun's mean altitude in April is to the mean heat of April, so is the sine of the sun's mean altitude in May to the mean heat of May. In the same manner the mean heats of June, July, and August, are found; but the rule would give the temperature of the succeeding months too low, because it does not take in the heat derived from the earth, which possesses a degree of heat nearly equal to the mean annual temperature. The

real temperature of these months therefore must be looked upon as an arithmetical mean between the astronomical and terrestrial heats.

But Mr. Kirwan, after going through a tedious calculation founded upon this principle, observed the results to agree so ill with experiment, that he drew up an extensive table of the monthly mean temperature of the standard from lat. 80° to lat. 10°, from which it appears that January is the coldest month in every latitude, and that July is the warmest month in all latitudes above 48°. In lower latitudes August is generally warmest. The difference between the hottest and coldest months increases in proportion to the distance from the equator. Every habitable latitude enjoys a mean heat of 60° for at least two months; this heat seems necessary for the production of corn. Within 10° of the poles the temperatures differ very little neither do they differ much within 10° of the equator; the temperatures of different years differ very little near the equator, but they differ more and more as the latitudes approach the poles.

2. That the temperature of the atmosphere gradually diminishes, according to its height above the level of the sea, is well known. Thus the late Dr. Hutton of Edinburgh found that a thermometer, kept on the top of Arthur's Seat, usually stood 3° lower than a thermometer kept at the bottom of it. Hence, then, a height of 800 feet occasioned 3° of diminution of temperature. On the summit of Pinchinca the thermometer stood at 30°, as observed by Bouguer, while at the level of the sea in the same latitude it stood at 84°. Here a height of 15,564 feet occasioned a diminution of temperature amounting to 54°. But, though there can be no doubt of the gradual diminution of temperature according to the height, it is by no means easy to determine the rate of diminution. Euler supposes it to be in a harmonic progression; but this opinion is contradicted by observations. Saussure supposes that in temperate climates the diminution of temperature amounts to 1° for every 287 feet of elevation. But Mr. Kirwan has shown that no such rule holds, and that the rate of diminution varies with the temperature at the surface of the earth. We are indebted to this philosopher for a very ingenious method of determining the rate of diminution in every particular case, supposing the temperature at the earth's surface known. See *Irish Trans.* viii. 356.

Since the temperature of the atmosphere is constantly diminishing as we ascend, it is obvious that at a certain height we arrive at the region of perpetual congelation. This region varies in height according to the latitude of the place; being highest at the equator, and descending gradually nearer the earth as we approach the poles. It varies also according to the season. M. Bouguer found the cold on the top of Pinchinca, one of the Andes, to extend from 7° to 9° below the freezing point every morning immediately before sun-rise. He concluded, therefore, that the mean height of the term of congelation (the place where it freezes during some part of the day all the year round) between the tropics was 15·577 feet above the level of the sea; but, in lat. 28°, he placed it in summer at the height of 13,440 feet. Now, if we take the difference between the temperature of the equator and the freezing point, it is evident that it will bear the same proportion to the term of congelation at the equator, that the difference between the mean temperature of any other degree of latitude and the freezing point bears to the term of congelation, in that latitude. Thus the mean heat of the equator being 84°, the difference between it and 32 is 52; the mean heat of latitude 28° is 72·3°, the difference between which and 32 is 40·3: Then 52 : 15577 :: 40·3 : 12072. In this manner Kirwan calculated the following Table:—

Lat.	Mean height of the Term of Congelation. *Feet.*	*Lat.*	Mean height of the Term of Congelation. *Feet.*
0°	15577	45°	7658
5	15457	50	6260
10	15067	55	4912
15	14498	60	3684
20	13719	65	2516
25	13030	70	1557
30	11592	75	748
35	10664	80	120
40	9016		

Beyond this height, which has been called the lower term of congelation, and which must vary with the season and other circumstances, Bouguer distinguished another, which he called the upper term of congelation; that is, the point above which no visible vapor ascends. Mr. Kirwan considers this line as much less liable to vary during the summer months than the lower term of congelation, and therefore has made choice of it to determine the rate of the diminution of heat, as we ascend in the atmosphere. Bouguer determined the height of this term in a single case and Kirwan has calculated the following table of its height for every degree of latitude in the northern hemisphere.

Table of the Height of the Upper Line of Congelation in the different Latitudes of the Northern Hemisphere.

N. Lat.	Feet.	N Lat.	Feet.	N. Lat.	Feet.	N. Lat.	Feet.
0°	28,000	26°	22,906	[illegible]	12,245	70°	4,413
5	27,784	27	22,389	[illegible]	11,750	[illegible]	4,354
6	27,644	28	21,872	50	11,253	72	4,295
7	27,504	29	21,355	51	10,124	73	4,236
8	27,364	30	20,838	52	8,965	74	4,177
9	27,224	31	20,492	53	7,806	75	4,199
10	27,084	32	20,146	54	6,647	76	4,067
11	26,880	33	19,800	55	5,617	77	4,015
12	26,676	[illegible]	19,454	56	5,533	78	3,963
13	26,472	35	19,169	57	5,439	79	3,911
14	26,268	36	18,577	58	5345	80	3,861
15	26,061	37	17,985	59	5251	81	3,815
16	25,781	38	17,303	60	5,148	82	3,769
17	25,501	39	16,801	61	5,068	83	3,723
[illegible]	25,221	[illegible]	16,207	62	4,989	[illegible]	3,677
19	24,941	41	15,712	63	4,910	85	3,631
20	24,661	[illegible]	15,217	64	4,831	86	8,592
21	24,404	[illegible]	14,722	65	4,752	87	3,553
22	24,147	44	14,227	66	4,684	88	3,514
23	23,890	[illegible]	13,730	67	4,616	89	3,475
[illegible]	23,633	[illegible]	13,235	68	4,548	90	3,432
25	23,423	47	12,740	69	4,480		

This method of estimating the diminution of temperature, has been found to agree remarkably well with observation; and hence it follows that the heat of the air at a distance from the earth would seem not to be owing to the ascent of hot strata of air from the surface of the earth, but to the conducting power of the air.

This rule, however, applies only to the temperature of the air during the summer months of the year. In winter the upper strata of the atmosphere are often warmer than the lower. Thus on the 31st of January, 1776, the thermometer on the summit of Arthur's Seat stood six degrees higher than a thermometer at Hawkhill, which is 684 feet lower.—Roy. Phil. Trans. 1777, p 777. Mr. Kirwan considers this superior heat, almost uniformly observed during winter, as owing to a current of warm air from the equator, which rolls towards the north pole during our winter.

Such, then, in general, is the method of finding the mean annual temperature all over the globe. There are, however, several exceptions to these general rules, which must here be mentioned.

That part of the Pacific Ocean which lies between N. lat. 52° and 66° is no broader at its northern extremity than forty-two miles, and at its southern extremity than 1300; it is reasonable to suppose, therefore, that its temperature will be influenced by the surrounding land, which consists of ranges of mountains, covered a great part of the year with snow; and there are besides a great many high, and consequently cold, islands scattered through it. For these reasons Mr. Kirwan concludes that its temperature is at least four or five degrees below the standard.

It is a well-known opinion that the southern hemisphere, beyond 40° of lat., is considerably colder than the corresponding parts of the northern hemisphere. Mr. Kirwan has shown that this holds with respect to the summer of the southern hemisphere, but that the winter in the same latitudes is milder than in the northern hemisphere.

Small seas surrounded with land, at least in temperate and cold climates, are generally warmer in summer and colder in winter than the standard ocean, because they are a good deal influenced by the temperature of the land. The Gulph of Bothnia, for instance, is for the most part frozen in winter; but in summer it is sometimes heated to 70°, a degree of heat never to be found in the opposite waters of the Atlantic. —Mem. Stock. 1776. The German Sea is above 3° colder in winter, and 5° warmer in summer than the Atlantic. The Mediterranean is, for the greater part of its extent, warmer both in summer and winter than the Atlantic. The Black Sea is colder than the Mediterranean.

The eastern parts of North America are much colder than the opposite coast of Europe, and fall short of the standard by about 10° or 12°. The causes of this remarkable difference are many. The highest part of North America lies between 40° and 50° of N. lat., and 100° and 110° of W. long. from London; for there the greatest rivers originate. The very height, therefore, makes this spot colder than it otherwise would be. It is covered with immense forests, and abounds with swamps and morasses, which render it incapable of receiving any great degree of heat; so that the rigor of winter is much less tempered by the heat of the earth than in the old continent. To the east lie a number of very large lakes; and, farther north, Hudson's Bay; about fifty miles on the south of which there is a range of mountains, which prevent its receiving any heat from that quarter. This bay is bounded on the east by the mountainous country of Labrador and by a number of islands. Hence the coldness of the north-west winds and the lowness of the temperature. But, as the cultivated parts of North America are now much warmer than formerly, there is reason to expect that the climate will become still milder when the country is better cleared of woods, though perhaps it will never equal the temperature of the old continent.

Islands are warmer than continents in the same latitude; and countries lying to the windward of extensive mountains or forests are warmer than those lying to the leeward. Stones or sand seem to have a less capacity for retaining heat than the other parts of the earth which are somewhat moist; they heat or cool, therefore, more rapidly, and to a greater degree. Hence the violent heat of Arabia and Africa, and the intense cold of Terra del Fuego. Living vegetables alter their temperature slowly, but their evaporation is great; and woody countries, as excluding the sun's rays from the earth, are much colder than those which are cultivated.

The atmosphere is affected by a general current from east to west, like that of the sea; and there is reason, from astronomical observations, to suppose that a similar circumstance happens in the atmosphere of Jupiter, on account of the actions of his satellites, which must be considerably more powerful than that of the moon.

The atmosphere is also liable to elevations and depressions analogous to those of the sea, and perhaps these changes may have some little effect on the winds and on the weather. 'The height of an aerial tide must,' says Dr. Young, 'be nearly the same with the observed height of the principal tides of the sea; and the variation of atmospherical pressure, which is measured between the difference of the actual form and the spheroid of equilibrium, must be equivalent to the weight of a column of about ten feet of air, or only $\frac{1}{100}$ of an inch of mercury. A periodical variation five times as great as this has, indeed, been observed near the equator, where the state of the atmosphere is the least liable to accidental disturbances; but this change cannot in any degree be referred to the effect of the moon's action, since it happens always about the same hour of the day or night.'

'The exact specific gravity of atmospherical air,' says Dr. Ure, 'compared to that of water, is a very nice and important problem. By reducing to 60° Fahr., and to thirty inches of the barometer, the results obtained with great care by MM. Biot and Arago, the specific gravity of atmospherical air appears to be 0·001220, water being represented by 1·000000. This relation expressed fractionally is $\frac{1}{820}$, or water is 820 times

denser than atmospherical air.' Mr. Rice, in the seventy-seventh and seventy-eighth numbers of the Annals of Philosophy, deduces from Sir George Shuckburgh's experiments 0·00120855 for the specific water of air. This number gives gravity to air as 827·437 to 1. If, with Mr. Rice, we take the cubic inch of water = 252·525 grs., then 100 cubic inches of air, by Biot's experiments, will weigh 30·808 grains, and by Mr. Rice's estimate 30·519. He considers with Dr. Prout the atmosphere to be a compound of four volumes of nitrogen, and one of oxygen; the specific gravity of the first being to that of the second as 1·1111 to 0·9722.

Hence

0·8 vol. nitr. sp. gr. .	0·001166	= 0·000933
0·2 oxy. . .	0·001340	= 0·000268
		0·001201

The numbers are transposed in the Annals of Philosophy by some mistake.

MM. Biot and Arago found the specific gravity of oxygen to be . . 1·10359
and that of nitrogen . . . 0,96913
air being reckoned . . . 1·00000

Or compared to water as unity—

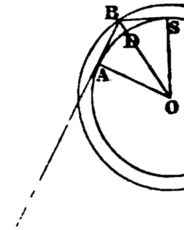
Nitrogen is .	0·001182338	
Oxygen . .	0·001346379	
And 0·8 nitrogen		= 0·00094587
0·2 oxygen		= 0·00026927
		0·00121514
And 0·79 nitrogen		= 0·000934
0·21 oxygen		= 0·000283
		0·001217

A number which approaches very nearly to the result of experiment. Many analogies, it must be confessed, favor Dr. Prout's proportions; but the greater number of experiments on the composition and density of the atmosphere agree with Biot's results. Nothing can decide these fundamental chemical proportions except a new, elaborate, and most minutely accurate series of experiments. We shall then know whether the atmosphere contains in volume 20 or 21 per cent. of oxygen.

On the subject of the *height of the atmosphere*, see the article Atmosphere. In addition to what is there stated, the famous problem of Kepler, as to its extent, should perhaps be noticed. He contended that the depression of the sun below the horizon, when twilight appears, will furnish data for ascertaining the altitude of the atmosphere, or at least of that portion of it which reflects the sun's parting rays.

Let S of the diagram, fig. 1, be the situation of a spectator on the surface of the earth, and A the point where the sun sets. The tangent, A B, will now mark the path of the lowest solar ray, which illuminates the highest part of the atmosphere at B, whence the emission of a secondary ray, B S, will barely reach the ground at A. But assuming the ordinary estimate, that twilight expires when the solar depression or the arc S A amounts to 18°, in the right-angled triangle S O B, the base O S, or the radius of the globe being 3956, and the acute angle S O B 9°, or the half of A O S, the hypothenuse O B is easily found,

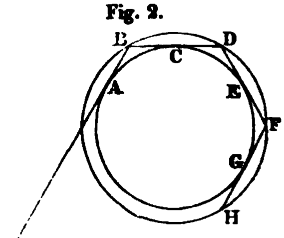
Fig. 1.



and hence about forty-nine miles is the excess B D of S B above S D, or the elevation of the limit of the atmosphere, enlightened by the sun's last rays. Some correction may be required for the deviation of rays from the rectilineal path, in consequence of the unequal refraction of them in different atmospheric strata; but this calculation is sufficiently near, and the suggestion was most ingenious.

M. Lambert, however, pushes this problem yet further. He observes (fig. 2) that we may

Fig. 2.



easily conceive that the rays S B, after impinging on the earth's surface at A, will illuminate the atmosphere to B, from which light will be darted in the direction of B C D, to tinge another elevated portion of the atmosphere at D, which will again cast rays on the spectator at E, or shoot onwards to the opposite sky at F, and thence reach, almost in a state of extinction, the ground at G. While, therefore, the first crepusculum would set in the west, the second would travel like a bow over the heavens, followed at a regular distance by the dusky veil of the third and fourth.

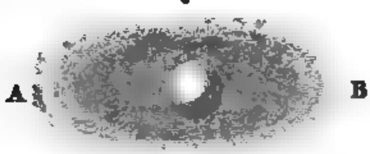
'But it may be computed,' observes Mr. Leslie, 'from the vast length of the tracts which the light would have to traverse, that those shades would in succession be 10,000 times darker.' The clearest sky, however, on the close of evening, never appears marked by such contrasts. 'It is most probable, therefore, that the diminution of light, after the close of evening, is owing to the prodigious rarefaction of much higher portions of the atmosphere, which still catch some faint rays of the sun, without being able, from excessive attenuation, to reflect them efficiently to the earth. But since, unless the sky be overcast, there is total darkness in no climate, even at midnight; we may, therefore, infer that the body of air extends to such an altitude as to receive the most dilute glimmer, after the

sun has attained its utmost obliquity, and sunk 90° below the horizon. It would thence follow that the elevation of the atmosphere must be equal at least to 1638 miles, or the excess of the hypothenuse of an isosceles right-angled triangle having 3956 miles, or the radius of the earth, for its base

'This very great extension of a rare expansive atmosphere appears conformable to the general phenomena. But the thin investiture of our globe, at least near the equator, may stretch out much farther; and yet its elevation can never exceed a certain absolute limit. The highest portions of the atmosphere, which is carried round in twenty-three hours and fifty-six minutes by the rotation of the earth about its axis, would be projected into space, if their centrifugal force at that distance were not less than their gravitation towards the centre. But the centrifugal force is directly as the distance, while the power of gravity is as its square. Consequently, when the centrifugal force at the distance of 6·6 radii of the earth is augmented as many times, the corresponding gravitation is diminished by its square or 43·7 times, their relative proportion being thus changed to 289. Now, the centrifugal force being only the 289th part of gravity at the surface of the equator, it will therefore just balance this power at the distance of 6·6 radii from the centre, or at the elevation of 22,200 miles.' Art. METEOROLOGY. *Supplement to the Encyclopædia Britannica.*

This writer observes, in defence of his hypothesis, that such an extent of atmosphere will occupy scarcely a twentieth part of the distance between the earth and the moon, which the ancients held to communicate with the atmosphere. He thus exhibits what he conceives the true figure of the earth and atmosphere. A B fig. 3 is the equatorial diameter.

Fig. 3.

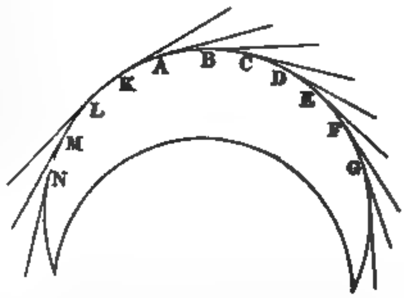


SECT. IV.—HYPOTHESIS RESPECTING THE VARIATIONS OF THE BAROMETER.

In our article BAROMETER we have noticed the early conjectures respecting the causes of the irregularities of that important instrument, and the valuable remarks of Deluc, Laplace, &c., on this subject. Mr. Leslie is, however, dissatisfied with every former theory on this point. 'The transition of the air from a state of dryness to humidity, seemed,' he says, 'to furnish the most plausible explication of the changes of the mercurial column. But the indication of the barometer was, in this case, distinctly at variance with the ordinary feelings of men. Those who suffer under a delicate or enfeebled constitution are accustomed in damp weather to complain of the air as heavier and less elastic. This language is, no doubt, metaphorical only, and descriptive of the disordered state of the nervous system; but it shows the utter fallacy of trusting in philosophical matters to the loose results of vulgar observation and experience. Moisture, so far from loading the air by its weight, communicates, like heat, increased expansion and elasticity. But, even supposing a column of air to become charged with humidity, before its subsequent dilatation had, by diffusing it, produced an equilibrium, still the additional pressure would have been extremely small, not exceeding, at a moderate computation, the fifteenth part of a mercurial inch. Any transition of that medium, from dryness to humidity, would be quite inadequate, therefore, to the production of the effects actually observed.'

He afterwards suggests the deflected course of a *horizontal current of air* as the most probable cause of these phenomena. 'Suppose,' he says, 'a current to begin to flow from A (fig. 4) in

Fig. 4.



the direction of a tangent, it will successively bend from a rectilineal track at the points B, C, D, E, F, G, &c., on the surface of the earth. The particles of the fluid are, therefore, drawn incessantly from their course by the action of gravity. Their vertical pressure is consequently diminished by the force spent in producing this deflection. During the prevalence of the wind the atmospheric column will press with inferior weight at B than at A, at C than at B, at D than at C; thus gradually decreasing through the whole chain. Suppose the intervals A B, B C, C D, D E, &c., to be each of them a mile, and that the current reaches the points B, C, D, E, &c., in successive minutes, a celerity which frequently happens; the deflection at B, owing to the curvature of the earth, would be eight inches, or two-thirds of a foot; but the space through which a body would descend in a minute, by the action of gravity, is $60 \times 60 \times 16 = 57600$ feet, or 86400 times greater than the deviation from the tangent. Wherefore the atmospheric pressure would, on that hypothesis, be diminished by the $\frac{1}{86400}$th part for each interval of a mile, from A to G. In the space of 288 miles this diminution would consequently be the $\frac{1}{300}$th part of the incumbent weight; and over an extent of 2880 miles it would amount to the thirtieth part. If we assume the very probable estimate, that storms involve the whole region of the clouds, or attain an elevation of nearly three miles, the diminution of pressure, occasioned by a long series of deflections in the stream, would affect one-half

of the atmosphere. Wherefore, a wind which has blown over a track of 2880 miles, at the rate of sixty miles an hour, might cause the mercurial column to subside half an inch. If the velocity of the wind were doubled, which is probably the limit of the most tremendous hurricane, the fall of the barometer would be four times greater, and amount to two inches. That the same powerful wind can sweep over an immense track of surface is well ascertained. The effects of a hurricane originating in the West Indies, at the distance of 5000 miles, have often been felt on our shores. But a wind arising at A must evidently be followed, at succeeding intervals, by a current from K, L, M, &c., the range of influence being thus extended over a larger track. During the flow of the air the depression of the barometer at G will be maintained, or rather augmented.'

He afterwards suggests that the winds, though thus regarded as describing only great circles about the earth, may be constrained to bend into smaller ones; and thus exert even a greater influence over the barometer. Thus also he would explain the phenomena of eddies, whirlwinds, and tornadoes. See Winds.

Sect. V.—Theory of Mists, Dews, and Rain.

Sir Humphry Davy in a paper inserted in the Philosophical Transactions 1819, part I., suggests that land and water cool after sunset in a very different manner. The impression of cooling on the land is limited to the surface, and is very slowly transmitted into the interior; whereas in water the upper stratum, when cooled, descends, and has its place supplied by warmer water from below. The surface of the water will therefore, in calm and clear weather, and in temperatures above 45° Fahrenheit, be warmer than that of the contiguous land; and consequently the air above the land will be cooler than that above the water. When the cold air, therefore, from the land mixes with that above the water, both of them containing their due proportion of aqueous vapor, a mist or fog must be the result.

It is necessary, therefore, for the formation of mists, that the temperature of the water should be greater than that of the air: for the deposition of dew (according to Dr. Wells, see our article Dew), requires that the heat of the body on which it is deposited should be less than that of the atmosphere.

There are three principal conditions to be considered, when the formation of dew is taken in conjunction with that of mist, according to an able paper of Mr. Harvey's of Plymouth, in the Edinburgh Philosophical Journal.

In the first place the temperature of the water, and the law according to which it cools; secondly, the temperature of the land, and the law by which it radiates its heat to the sky; and, thirdly, the quantity of vapor contained in the air. The varied character of these conditions must necessarily impart a corresponding diversity to the results. The same circumstances of temperature which in one case would produce a copious deposition of dew, and a mist of considerable density, in another case would produce only a moderate formation of each; and, even if we suppose the quantity of atmospheric moisture to remain constant, alterations of temperature will occasion innumerable varieties of both.

'When the atmosphere is completely saturated with vapor, the greatest quantity of dew will be deposited, when the land, by a free radiation to a pure and tranquil sky, has its temperature diminished by the greatest possible quantity below that of the air reposing on its surface; and a mist of the greatest degree of density will be formed, when the temperature of the adjacent water is above that of its superincumbent air, also by the greatest possible quantity. The temperatures of the two masses of air, although unequal, may therefore be regarded as occupying a kind of middle state between the extremes here alluded to. In all cases the density of a mist will be jointly proportional to the difference of temperature between the sea and land, and the quantity of vapor held in solution by the atmosphere at the time of its formation.

'To show, however, the quantities of moisture that will be precipitated in the form of mist, fog, or rain, from the mingling together of equal masses of perfectly saturated air, of different degrees of temperature, the following examples are given; from which it will be perceived that the moisture deposited increases with the difference of temperature of the volumes of air. The temperatures are those of the centesimal scale; and the grains of vapor are what a metrical cube of air contains at the respective temperatures, when in a state of saturation, according to the experiments of professor Leslie.

Temperatures.	Grains of vapor dissolved in a metrical cube of Air, at the respective Temperatures.	Means of the preceding.	Grains of Vapor dissolved in a metrical cube of Air, at the means of the respective Temperatures.	Grains of Vapor deposited in the form of Mist, Fog, or Rain.
4° 6	120·3 132·0	126·1	126·0	0·1
4 8	120·3 144·7	132·5	132·0	0·5
4 10	120·3 158·7	139·5	138·2	1·3
4 12	120·3 174·1	147·2	144·7	2·5
4 14	120·3 191·0	155·6	151·6	4·0
4 16	120·3 209·5	164·9	158·7	6·2
4 18	120·3 229·7	175·0	166·2	8·8
4 20	120·3 252·0	186·1	174·1	12·0

It appears from this table that, when the difference between the temperatures of the two metrical cubes of air amount to two centesimal degrees, the quantity of vapor deposited by a

metrical cube of the mixed air amounts only to one-tenth of a grain, whereas the union of similar volumes at the temperatures of 4° and 20°, occasions a precipitation of twelve grains. The greater the difference, therefore, between the temperatures of the equal masses of air, the greater will be the density of the mist formed by their union. It does not follow, however, that nature, in the infinite diversity of her operations, is confined, as in the particular case here considered, to the mingling together of equal volumes of perfectly saturated air, or of air containing a less proportion of moisture. Two or more parts of one particular temperature, and with any assignable degree of moisture, may be blended with other proportions of air, of a different temperature, and having other relations of moisture; and from such will arise mists of every variety of density.

Circumstances may be favorable, according to this writer, to the deposition of dew on the borders of rivers, without contributing to the formation of mists. The atmosphere contains, at all times, some moisture; and, therefore, when the relations of the temperature of the air and land are suitable, and a clear and tranquil sky prevails, a deposition of dew of some degree or other will take place. But, although the relations of temperature between the land and water may be favorable to the formation of mist, it by no means follows that the union of volumes of air, of unequal temperatures, will produce a visible condensation. In some examples which I have witnessed, says Mr. Harvey, the extreme tenuity of the mist has indicated, that the circumstances of temperature and vapor were such as just to admit of its formation.

'The deposition of dew,' he concludes, 'must always precede the formation of mists. This will appear evident, when we consider the principles to which each owes its origin. Suppose at some moment an equality of temperature to take place between the water, the land, and the volumes of air reposing over each. In consequence of the unequal cooling powers of the land and water, the former will first have its temperature reduced below that of the air: and although by this diminution the equality of temperature between the two volumes of air will be destroyed, and a condition created favorable to the formation of mist; still, as the cooling of the first volume and the mingling of the two are not contemporaneous acts, dew will be the first deposited. In proportion, however, as the land radiates freely, with the same rapidity must the temperature of the superincumbent air be diminished, and the equilibrium between it and the atmosphere hovering over the water be disturbed. The rapid formation of dew is therefore accompanied by circumstances favorable to the quick formation of mist; and it hence becomes probable, that, under such conditions, mist will be formed at an earlier period of the night, than when the land radiates less copiously, and dew is deposited in less abundance.

'If, in consequence of the interposition of a canopy of clouds, the cooling of the land and water should be checked, and an equality of temperature be restored between the two masses of air, and the bodies on which they respectively repose, the deposition of dew will be suspended, and likewise all tendency to the farther formation of mist. The entire dissipation of the latter may likewise result from the change. Or if we suppose a temporary interposition of clouds, and conceive the land to radiate its heat only at intervals, corresponding changes of temperature will immediately follow; an increase of heat taking place when the sky is obscured, and a diminution when its clearness is restored. Dr. Wells has furnished a case wherein the temperature of grass increased 15° in the short space of forty-five minutes, and which was at the same time accompanied by an elevation in the temperature of the air of 3½°. Nor is it improbable but that examples sometimes occur, of dew and mist being deposited in the former part of the night, and both disappearing before the morning; or, as it may sometimes happen, the former be preserved, and the latter dissipated. The first of these phenomena may take place, when a portion of the night, favorable to the formation both of mist and dew, is succeeded by a brisk wind; and the second, when, by the interposition of dense clouds, the temperature of the land is raised, which, by imparting its influence to its superincumbent air, restores it to a temperature equal to, or even greater than, that of the atmosphere reposing on the water, ultimately causing the mist to disappear, from the increased capacity of the air for vapor. This latter circumstance will also account for the dispersion of mists in the morning, before the disappearance of dew. The gentle motion that must also take place, from the mingling of the cold air from the land with the warmer air above the water, will have a tendency to increase the deposition of dew, since new volumes of air will be successively brought into contact with the cold surface of the earth, and by depositing their moisture, will augment the quantity of dew beyond what would otherwise have been formed, had the atmosphere remained perfectly calm. Dr. Wells found that a slight agitation of the air was always accompanied with an increase of dew. The general tenor of these observations is confirmed by a remark of the same indefatigable observer, that 'dew is always very copious on those clear and calm nights which are followed by misty or foggy mornings.''

Dr. Hutton's theory of rain we have already noticed in the article Clouds. Mr. Leslie, who fully espouses this theory, says, 'The profuse precipitation of humidity is caused by a rapid commixture of opposite strata. The action of swift contending currents in the atmosphere brings quickly into mutual contact vast fields of air over a given spot. The separation of moisture is hence proportionally copious. In temperate weather this deposition forms rain; but, in the cold season, the aqueous globules, freezing in the mid-air into icy spiculæ, which collect in their slow descent, become converted into flakes of snow. Hail is formed under different circumstances, and generally in sudden alternations of the fine season, the drops of rain being congealed during their fall, by passing through a lower stratum of dry and cold air.

'The drops of rain vary in their size perhaps from the twenty-fifth to a quarter of an inch in diameter. In parting from the clouds, they precipitate their descent till the increasing resistance opposed by the air becomes equal to their weight, when they continue to fall with a uniform velocity. This acquired or terminal velocity is therefore in the subduplicate ratio of the diameters of the aqueous globules. A thunder shower hence pours down much faster than a drizzling rain. In general, if d express the diameter of a drop in parts of an inch, the terminal velocity, according to theory, will be denoted by $78\sqrt{d}$, or, if the usual correction be made for the discrepancy in fluids, it will be $67\sqrt{d}$. Thus a drop of the twenty-fifth part of an inch, in falling through the air, would only gain a celerity of eleven feet and a half, while one of a quarter of an inch would acquire a celerity of thirty-three feet and a half. A flake of snow, being perhaps nine times more expanded than water, would descend thrice as slow. But hail-stones are often of considerable dimensions, exceeding sometimes the length of an inch. They may hence fall with a velocity of seventy feet each second, or at the rate of about fifty miles in the hour. Striking the ground with such impetuous force, it is easy to conceive the extensive injury which a hail shower may occasion in the hotter climates. The destructive power of those missiles, in stripping and tearing the fruits and foliage, increases besides in a faster ratio than the momentum, and may be estimated by the square of their velocity multiplied into mass. This fatal energy is hence as the fourth power of the diameter of the hail-stone.'

Mr. Luke Howard of London, one of our ablest writers on the subject of clouds, is inclined to attribute rain, with abbé Nollet and Beccaria, to the electrical action of the clouds upon each other.

In the formation of the rain-cloud (nimbus), two circumstances, he thinks, claim particular attention; the spreading of the superior masses of cloud, in all directions, until they become like the stratus one uniform sheet; and the rapid motion, and visible decrease, of the cumulus when brought under the latter. The cirri also, which so frequently stretch from the superior sheet upwards, and resemble erected hairs, carry much the appearance of temporary conductors for the electricity, extricated by the sudden union of minute particles of vapor, into the vastly larger ones that form the rain. By one experiment of Cavallo's, with a kite carrying 360 feet of conducting string, in an interval between two showers, and kept up during rain, it seems that the superior clouds possessed a positive electricity before the rain, which, on the arrival of a large cumulus, gave place to a very strong negative, continuing as long as it was over the kite. We are not, however, warranted from this to conclude the cumulus which brings on rain always negative, as the same effect might ensue from a positive cumulus uniting with a negative stratus. Yet the general negative state of the lower atmosphere during rain, and the positive indications commonly given by the true stratus, render this the more probable opinion. It is not, however, absolutely necessary to determine the several states of the clouds which appear during rain, since there is sufficient evidence in favor of the conclusion, that clouds formed in different parts of the atmosphere operate on each other, when brought near enough, so as to occasion their partial or entire destruction; an effect which can be attributed only to their possessing beforehand, or acquiring at the moment, the opposite electricities.

'It may be objected,' says Mr. Howard, 'that this explanation is better suited to the case of a shower than to that of continued rain, for which it does not seem sufficient. If it should appear, nevertheless, that the supply of each kind of cloud is by any means kept up in proportion to the consumption, the objection will be answered. Now, it is a well known fact, that evaporation from the surface of the earth and waters, often returns and continues during rain, and consequently furnishes the lower clouds, while the upper are recruited from the quantity of vapor brought by the superior current, and continually subsiding in the form of dew, as is evident both from the turbidness of the atmosphere in rainy seasons, and the plentiful deposition of dew in the nocturnal intervals of rain. Neither is it pretended that electricity is any farther concerned in the production of rain, than as a secondary agent, which modifies the effect of the two grand predisposing causes,—a falling temperature, and the influx of vapor.'

Mr. Dalton, who has also paid much attention to this subject, read before the Manchester Society an elaborate and interesting memoir on rain, from which we extract the following table and observations.

Mean Monthly and Annual Quantities of Rain at Various Places, being the averages for many years, by Mr. Dalton.

	Manchester, 33 years.	Liverpool, 18 years.	Chatsworth, 16 years.	Lancaster, 20 years.	Kendal, 25 years.	Dumfries, 16 years.	Glasgow, 17 years.	London, 40 years.	Paris, 15 years.	Viviers, 40 years.	General average.
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Fr. In.	Fr. In.	Inch.
Jan.	2·310	2·177	2·196	3·461	5·299	3·095	1·595	1·464	1·228	2.477	2·530
Feb.	2·568	1·847	1·652	2·995	5·126	2·837	1·741	1·250	1·232	1·700	2·295
Mar.	2·098	1·523	1·322	1·753	3·151	2·164	1·184	1·172	1·190	1·927	1·748
April	2·010	2·104	2·078	2·180	2·986	2·017	0·979	1·279	1·185	2·686	1·950
May	2·895	2·573	2·118	2·460	3·480	2·568	1·641	1·636	1·767	2·931	2·407
June	2·502	2·816	2·286	2·512	2·722	2·974	1·343	1·738	1·697	2·562	2·315
July	3·697	3·663	3·006	4·140	4·959	3·256	2·303	2·448	1·800	1·882	3·115
Aug.	3·665	3·311	2·435	4·581	5·039	3·199	2·746	1·807	1·900	2·347	3·103
Sept.	3·281	3·654	2·289	3·751	4·874	4·350	1·617	1·842	1·550	4·140	3·135
Oct.	3·922	3·724	3·079	4·151	5·439	4·143	2·297	2·092	1·780	4·741	3·537
Nov.	3·360	3·441	2·634	3·775	4·785	3·174	1·904	2·222	1·720	4·187	3·120
Dec.	3·832	3·288	2·569	3·955	6·084	3·142	1·981	1·736	1·600	2·397	3·058
	36·140	34·118	27·664	39·714	53·944	36·919	21·331	20·686	18·649	33·977	

Observations on the theory of rain.—'Every one must have noticed an obvious connexion between heat and the vapor in the atmosphere. Heat promotes evaporation, and contributes to retain the vapor when in the atmosphere, and cold precipitates or condenses the vapor. But these facts do not explain the phenomenon of rain, which is as frequently attended with an increase as with a diminution of the temperature of the atmosphere.

'The late Dr. Hutton of Edinburgh was, I conceive, the first person who published a correct notion of the cause of rain. See Edinburgh Transactions vol. i. and ii. and Hutton's Dissertations, &c. Without deciding whether vapor be simply expanded by heat, and diffused through the atmosphere, or chemically combined with it, he maintained from the phenomena that the quantity of vapor capable of entering into the air increases in a greater ratio than the temperature; and hence he fairly infers that, whenever two volumes of air of different temperatures are mixed together, each being previously saturated with vapor, a precipitation of a portion of vapor must ensue, in consequence of the mean temperature not being able to support the mean quantity of vapor. The cause of rain, therefore, is now, I consider, no longer an object of doubt. If two masses of air, of unequal temperatures, by the ordinary currents of the winds are intermixed, when saturated with vapor, a precipitation ensues. If the masses are under saturation, then less precipitation takes place, or none at all, according to the degree. Also the warmer the air, the greater is the quantity of vapor precipitated in like circumstances. Hence the reason why rains are heavier in summer than winter, and in warm countries than in cold.

'We now enquire into the cause why less rain falls in the first six months of the year than in the last six months. The whole quantity of water in the atmosphere in January is usually about three inches, as appears from the dew point, which is then about 32°. Now the force of vapor at that temperature is 0·2 of an inch of mercury, which is equal to 2·8 or three inches of water. The dew point in July is usually about 58° or 59°, corresponding to 0·5 of an inch of mercury, which is equal to seven inches of water; the difference is four inches of water, which the atmosphere then contains more than in the former month. Hence, supposing the usual intermixture of currents of air in both the intervening periods to be the same, the rain ought to be four inches less in the former period of the year than the average, and four inches more in the latter period, making a difference of eight inches between the two periods, which nearly accords with the preceding observations.'

On the subject of the electricity of the atmosphere, see Electricity.

For the current of the atmosphere and the origin of winds, see Winds.

Sect. VI.—Of the Modern Meteorological Instruments.

Modern times, and the researches of the many eminent experimenters in this science, have given birth to a variety of excellent meteorological instruments which will generally be found described in their alphabetical place. See Barometer, Hygrometer, Thermometer, Wind Gauge, &c. Under the article Thermometer will be found the photometer and æthrioscope, both species of the differential thermometer; the atmometer, cyanometer, drosometer, and embrometer or rain-guage we shall here describe.

The *atmometer*, or evaporometer, is designed to measure the quantity of water evaporated in any given time. A circular basin, of uniform width from top to bottom, is the simplest form of the instrument: it is filled with water and the quantity evaporated may be ascertained by means of a graduated glass tube, similar to that employed

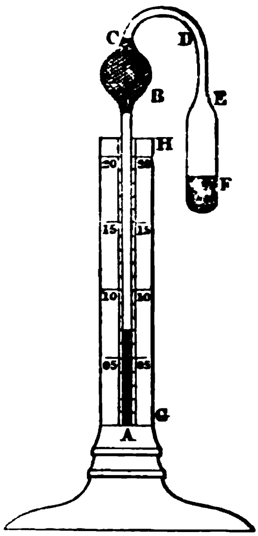
for measuring the depth of rain. There are difficulties, however, attending the use of the instrument, which often render it an uncertain indication of the absolute quantity evaporated. If it be fully exposed to the sun and wind, the heat acquired by the vessel will rapidly promote evaporation; and if the basin be kept nearly full, as it ought to be, the water will be agitated and thrown about by the wind.

A few years ago Mr. Leslie constructed an instrument of this kind on a very simple principle. It consisted of a ball of porous earthenware, two or three inches in diameter, into which was inserted a glass tube, so graduated that the quantity of water contained between two divisions of it would cover the outer surface of the ball to the depth of the $\frac{1}{1000}$th part of an inch. The ball and tube being filled with water, the top of the latter was covered with a brass cap, which, by means of a leather collar and screw, was made air-tight, and the instrument, being suspended out of doors, was freely exposed to the wind. In this state the humidity exuded through the surface of the ball as fast as it evaporated, and the descent of the column in the tube indicated the quantity evaporated. The pressure of the atmosphere being in a great measure removed, by the tightness of the collar, the water is prevented from passing through the ball of this instrument so quickly as to drop, while the space which it leaves empty at the top is occupied by the very minute stream of air which is imbibed by the moisture on the outside, and may be seen rising through the water in the tube.

'Of this instrument,' Mr. Leslie says, 'if the atmometer had its ball perfectly screened from the agitation of wind, its indications would be proportional to the dryness of the air at the lowered temperature of the humid surface; and the quantity of evaporation every hour, as expressed in the $\frac{1}{1000}$th part of an inch, would, when multiplied by twenty give the hygrometric measure. For example, in this climate, the mean dryness in winter being reckoned 15°, and in summer 40°, the daily exhalation from a sheltered spot must in winter form a thickness of ·018, and amount in summer to ·048 decimal parts of an inch. Suppose a pool for the supply of a navigable canal exposed a surface equal to ten English acres, and that the atmometer sank eighty parts during the lapse of twenty-four hours; the quantity of water exhaled in that time would be $\frac{80}{12000} \times 660 \times 66 \times {\cdot}10$, or 2904 cubic feet, which corresponds to the weight of eighty-one tons.

But the atmometer since invented by Mr. Anderson seems the best instrument of the kind hitherto proposed: it is thus described in the Edinburgh Philosophical Journal:—

Let A B C D E F represent a bent glass tube of sufficient width to admit of a liquid moving easily from one part to another, and swelling out into the bulbs B C and E F. Into this tube at A is introduced a quantity of alcohol, which, after being conveyed into the bulb or wider tube E F, is thrown into a state of ebullition; and, while the steam is issuing from A, the tube is there hermetically sealed, so that the air is completely expelled from the space A B C D E. The bulb B C is then covered with moistened silk or paper, and the instrument freely exposed. In consequence of the pressure of the air being removed from the surface of the alcohol, in the bulb E F, a portion of that liquid passes into vapor, and occupies the empty part of the tube. Were the whole of the instrument at the same temperature, this process would in deed quickly be stopped by the pressure of the vapor itself on the surface of the alcohol; but, as the bulb B C has its temperature reduced by the external evaporation from the moistened silk or paper, the vapor which rises from E F is there condensed, and runs down in a liquid state into the tube A B. This distillation goes on more or less rapidly, according to the degree of cold induced upon the bulb B C, that is, in proportion to the external evaporation; and, consequently, the quantity of liquid collected in the tube A B is a measure of that evaporation. When the atmosphere is completely saturated with moisture, or when the evaporation ceases, the temperature of A B will be the same as that of any other part of the tube; and the distillation, therefore, for the reason already stated, will also cease.



'The measure of evaporation thus found is expressed in inches and decimals of an inch, by means of an attached scale G H, the divisions of which are determined by experiment. Suppose, for example, that the instrument is exposed to similar circumstances with an evaporating basin, and that the quantity evaporated from the latter in a given time, as determined either by weight or measurement, is found to be one-tenth of an inch, while the alcohol distilled by the former in the same time fills the tube A B to the depth of one inch; then the scale, being divided into inches and tenths, will indicate tenths and hundredths of an inch of evaporation. By increasing the proportion between the diameters of E F and A B, the quantity of evaporation may be measured to any degree of minuteness required. In using the instrument, the tube E F is to be sheltered from rain by enclosing it in a case or cover, to prevent its temperature being reduced below that of the atmosphere by subsequent evaporation; and the bulb B C is to be kept constantly moist by means of a small cup containing water attached to the tube immediately below it, the silk or paper being in contact with the water, or from an adjoining vessel, as in the case of the hygrometer. The instrument is placed in a vertical position, and is prepared for a new observation by inverting it, so that the distilled alcohol

may be conveyed back to the tube E F. It is to be hoped that this beautiful and ingenious contrivance will soon meet with that reception among meteorologists to which its merits so well entitle it. This atmometer has already been constructed, and is found to possess the utmost delicacy. It is probable that it may in time supersede the use even of the hygrometer.'

The *cyanometer* (κυανος, cœrulean or sky-blue, and μετρον, a measure), is an invention of M. de Saussure to measure the intensity of the blue color of the atmosphere. It consists of a circular band of paper, divided into fifty-three parts, each of which was painted with a different shade of blue; beginning with the deepest mixed with black, to the lightest mixed with white. He found that the color of the sky always corresponded with the deepest shade of blue the higher the observer is placed above the surface. The color becomes always lighter in proportion to the vapors mixed with the air. From morning till noon, the color of the vertical sky darkened, but became lighter again as the evening advanced; and this transition was wider and more rapid in great elevations. On the Col du Geant the tint of the horizontal air at sunrise was five, it deepened to eleven and a half at noon, but again relapsed to five towards night. On the 15th of July, which was a very clear day, the atmosphere at the horizon had the eleventh shade; at the altitude of 10° the twentieth; at that of 20° the thirty-first; at that of 30° the thirty-fourth; at that of 40° the thirty-seventh; and thence with any sensible variation to the zenith. Humboldt found, in his voyage from Corunna to Cumana, the tints of the sky to vary by the cyanometer, from thirteen to twenty-four, and again to sixteen, while the color of the ocean fluctuated between thirty-four and forty-four.

Some writers have considered these experiments to prove that the color of the atmosphere is wholly owing to its vapors; and that, at a certain height, the blue will disappear altogether, and the sky appear black; that is to say, will reflect no light at all. Mr. Leslie on the other hand (and we confess his reasoning appears to us correct) considers air like water, to be by its constitution a colored fluid. The former, he says, is naturally blue, as the latter is green; but these colors acquire intensity only from the *depth* of the transparent mass. A small body of limpid water has the appearance of crystal, but, in proportion as it accumulates, it assumes all the successive shades till it rivals the tints of the emerald and the beryl. This gradation is distinctly seen in the profound lakes of Switzerland, whose lustre is never stained by any vegetable infusion. The same series of colors emerges, on receding from our shores and approaching the vast abyss of the Atlantic Ocean. At first the water on the shelving banks is merely translucid; at the depth of ten fathoms it appears greenish, and the tint, by degrees, becomes more intense till it passes into a full green, at the depth of fifty fathoms; but, beyond soundings, it darkens almost into azure. In like manner the blue shade of the air becomes more intense in proportion to the length of the tract of light. This we perceive in viewing distant objects, whose colors are always tinted by the deepening hues of the interjacent range of atmosphere. The remotest hills seem lost in a cœrulean vesture. The mixture of aqueous vapors only diffuses a mist, which tarnishes rather than dilutes the fine blue.'

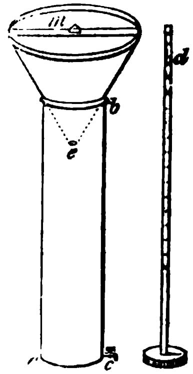
The *drosometer*, or dew-balance, is an instrument proposed by M. Weidlen of Germany, so far back as 1727, to measure, or rather weigh, the quantity of dew that falls on the surface of a body exposed to the night air. It consists of a bent balance, marked in grains which show the preponderance which a piece of glass of certain dimensions, laid horizontally in one of the scales, acquires, from the settling of the globules of moisture upon it. The main objection to this instrument, as to several others of a meteorological kind, is, that it requires to be protected from the wind, which cannot be accomplished without also screening it from a large portion of the dew that falls. The steel beam, too, soon loses its polish, and thus becomes unfit for accurate observation.

A more convenient drosometer is proposed by Mr. Leslie on the principle of the ombrometer, or rain-gauge. 'Suppose a glass funnel, of about three inches diameter, whose interior surface is very smooth and slopes towards the centre, at an angle of fifteen or twenty degrees, to be joined hermetically to a long tube, sealed at the lower end, and having an equable bore not exceeding a quarter of an inch, with an attached scale divided into portions, corresponding to the $\frac{1}{1000}$th parts of an inch, on the external aperture. The only difficulty is to make the dew which gathers during the night to run down the sides of the funnel into the tube. To facilitate this descent, a coat of deliquated salt of tartar may be spread with a hair pencil over the shallow surface, and renewed as often as occasion requires. The dew, instead of settling in minute detached globules, would then be attracted by the alkaline lye, which thus becoming dilute would gradually flow into the narrow cavity of the tube. It would be easy at any time to make an allowance for the very small portion of liquid alkali blended with the dew.'

The *ombrometer*, or *rain-gauge*, is a simple instrument, contrived to indicate the quantity or depth of rain which falls upon any spot. It has also been called an hyetometer. It is generally composed of a circular basin of iron lined with tin, soldered to the top of a vertical cylinder, which is contracted in some given proportion and close below. A small float is introduced, bearing a slender rod, distinguished by the corresponding divisions. Mr. Partington in his Manual of Natural and Experimental Philosophy, 2 vols. 8vo., thus describes a very useful one:—

'In the accompanying figure, it is seen to consist of a funnel *m*, attached to the top of a cylindrical vessel *b*. The bottom, *a c*, is furnished with a stop-cock to draw off the water when full, and also to open a communication with the graduated glass tube *d*. The tube is divided into parts, so as to register the quantity of water that enters the vessel, and so proportioned as to compensate for the difference between the sizes of funnel and cylinder.

'In fixing rain gauges,' says the above au-



thor, 'care should be taken that the rain may have free access to them, without being impeded or overshaded by any adjacent building. It may be proper also to add that, when the quantities of rain collected in them in different places are compared together, the instruments ought to be fixed at the same height above the ground at both places; because at different heights the quantities are always different, even in the same place. And hence, also, any register, or account of the rain in the gauge, ought to be accompanied with a note of the height at which the instrument is placed above the ground. Dalton found the rain of a gauge fifty yards high, in summer two-thirds, and in winter one-half as much as that of a gauge below. The above ingenious experimentalist adds, that a strong funnel, made of sheet-iron, tinned and painted, with a perpendicular rim, two or three inches high, fixed horizontally in a convenient frame, with a bottle under it to receive the rain, is sufficient for this purpose.'

Sect. VII.—Of the Optical Appearances and Delusions of the Atmosphere.

At once the most regular and most splendid of these is the *rainbow*, a phenomenon whose laws were calculated mathematically by Descartes, but not fully explained until the optical investigations of Sir Isaac Newton. 'In the formation of this meteor,' says the late Dr. Mason Good, 'it is necessary to observe that the ray which issues from the centre of the sun, and does not immediately, or perpendicularly, pass through the centre of the opposed globule of rain, must, upon the common principles of dioptrics, in consequence of its entering a transparent body of a different medium from the atmosphere itself, in a certain degree, be bent, deflected, or refracted from the right line in which it was proceeding; and hence, instead of passing out at the posterior part of the globule, immediately opposite to that at which it entered, it will be driven towards another limb, or marginal portion of the globule, and form an angular line co-equal to the obliquity with which it deviates from a right line on its entrance into the globule; just as a stake, or the oar of a boat, plunged obliquely into a river, appears to be broken, or deflected, from the point at which it enters the water. At this point the refracted ray, instead of passing out of the globule, suffers another deflection, but from a very different cause; for the ray of light having been thrown across a certain portion of the posterior chamber of the globule of rain, without permeating it, all behind its passage becomes necessarily a dark shade, while the globule itself forms an anterior and polished surface to it; whence a regular mirror is produced, and the ray is now reflected or thrown back from it, in the same manner as an incidental ray of light, or image, is reflected or thrown back from a looking-glass, or a deep and clear stream of water; both of which, like the globule thus situated, consist of nothing more than a dark shadow with a polished surface: the obliquity of its path, in the present instance, being precisely similar to that which it has previously suffered from refraction: the angular line of reflection being always co-equal with the angular line of incidence. It is hence obvious that the ray, or fascicle of parallel rays, which entered obliquely below the centre of the globule opposed to the centre of the sun, must be reflected obliquely above it; and as the same process necessarily takes place, but in an inversed order, with the antagonist ray, or fascicle of parallel rays that entered with the same degree of obliquity above it, it is also obvious that, from this double refracting and reflecting power of an individual globule of rain, situated as above described, an angle of light must be formed, from their antagonism alone, exhibiting the different colors of which they consist in a definitive order, according to the degree of their refrangibility; that the spread, or hypotheneuse of the angle must depend upon the diameter of the globule which produces it; and that its point being softened or obtunded to the eye, by the distance through which it is beheld, the angle must be converted into an arch. Hence, a beautiful and variegated rainbow must necessarily result from a few rays of light acted upon by a single globule of rain, situated as above, from the fact alone of its possessing the power of a binary mirror or prism.'

This writer accounts in a similar manner for the *mirage*, although it is chiefly to be noticed when the sky is clear and unclouded, and in the morning; but principally upon the coasts or banks of a large river See Optics

'The mirage seen by M. Crantz was on the shore of the Kookoernan Islands, near the Cape of Good Hope; it has often been traced at the back of the Isle of Wight; but the quarter in which, perhaps, it most frequently makes its appearance, is the Faro of Messina in Italy. In all these places, when the weather is perfectly calm, and consequently the sea almost without motion, the atmosphere, more especially in a dry and hot season, imbibes a considerable portion of the water upon which its lower stratum presses; and hence, in the night-time, becomes condensed and hazy. As the morning rises, however, and the sun-beams resume their vigor, the atmosphere once more rarefies, and re-acquires its transparency. If it rarefy equably, and homogeneously, every object beheld through it must necessarily be exhibited in its real proportion and figure: but it happens, occasionally, that in some parts of its texture it seems to be more closely interwoven than in others; and hence in its general expansion, veins, or striæ, like those often discovered in glass, make their appearance, of different densities and diameters. In this case, every stria, like every globule of rain, in consequence of the variation of its density from the common density of the atmosphere, becomes a refracting or a reflecting body; in other words, a prism, or a mirror, or both. If, then, a single globule of rain, properly disposed, be able to produce a phenomenon so marvellous as that of

the rainbow, what phenomena may we not expect, what variation, inversion, contortion, and grotesque and monstrous representation of images, beheld through a column of the atmosphere, intersected by so many aërial prisms of different densities, and mirrors of different surfaces, in which the catheti may be innumerable, and for ever varying? We may hence, moreover, readily trace the cause of an occasional duplication of images in the atmosphere, of a parhelion, and paraselene, or double sun, and double moon, from the reflection of these luminaries in an opposite part of the heavens, when they are a little above the horizon; as also of the very curious mirage remarked by M. Monge, in the hot and sandy desert between Alexandria and Cairo; in which, from an inverted image of the cœrulean sky intermixed with the ground scenery, the neighbouring villages appeared to be surrounded with the most beautiful sheeting of water, and to exist, like islands, in its liquid expanse, tantalizing the eye by an unfaithful represention of what was earnestly desired.'

'Our earliest enquiries,' says Mr. Leslie, 'led us to refer the origin of halos to the deflexion of light, or that property of the rays to bend and divide as they pass near the edge of a body. Thus the light admitted through a very narrow slit in a card, or a bit of tinfoil, spreads into bright colored fringes. The finer also is the slit, the broader are the fringes. A similar appearance is obtained by looking at the elongated flame of a candle through the delicate fibres of a feather, or even through the streaks of grease rubbed by the finger along a piece of glass. But, if a very small round hole be substituted for the slit, the fringes will change into colored rings. Thus, if a piece of tinfoil, punctured with the point of a needle, be held close to the eye, the sun will appear through it surrounded by a halo very near his disc, but spreading more in proportion as the hole is contracted. That ingenious artist, Mr. Troughton, constructed for us a slide of brass, and afterwards another of platina, perforated with a series of the finest conical holes, which were measured by his delicate micrometer. The purpose was to compare the angle subtended by the colored ring with the diameter of the perforation, it being inferred that an aqueous globule of the same dimension might, by the exterior deflexion of the solar rays, produce a similar halo. But our variable sky is very seldom fit for any refined optical experiment, and many delays happening to intervene, we could arrive at no very precise or certain result. We may state, however, as at least an approximation, that the globules of the diffuse vapor, which occasions the appearance of colored circles about the sun and moon, vary from the 5000th to the 50,000th part of an inch in diameter. When the halo approaches nearest to the luminous body, the largest globules are floating, and therefore the atmosphere is surcharged with humidity. Hence the justness of the vulgar remark, that a dense halo close to the moon portends rain.' Nearly the same theory is supported by Dr. Thomas Young, as we shall presently show.

Singular optical illusion in Baffin's Bay.—Among the remarkable illusions which arise from local variations in the density, and consequently in the refractive power of the atmosphere, we are not acquainted with any more interesting than one which was more than once observed by the officers on the late expedition to Baffin's Bay. Upon looking at the summits of distant mountains, they were surprised to observe a huge opening in them, as if they had been perforated, or an arch thrown from one to another. This effect arose from the apparent junction of the tops of the mountains, produced by a variation of density in some part of the atmosphere between the observer and the tops of the mountains, but which did not exist at a lower level, so as to affect the inferior parts of the mountains.

The *fata morgana* of the Mediterranean has been noticed by us in a distinct article. See Fata Morgana.

P. Minasi, whom we have quoted in the article referred to, enquires, in his able 'Dissertation,' into the etymology of Morgana. After various remarks, he thinks the opinion of those who derive this word, which is so foreign to the Roman idiom, from μωρος tristis, and γανοω lætitia afficio, is not far from the truth; considering the great exultation and joy this appearance produces in all ranks of people, who on its first commencement run hastily to the sea, exclaiming Morgana! Morgana! He remarks that he has himself seen this appearance three times, and that *he would rather behold it again than the most superb theatrical exhibition in the world.*

In the second chapter the author describes the city of Reggio, and the neighbouring coast of Calabria: by which he shows that all the objects which are exhibited in the Fata Morgana are derived from objects on shore.

In his third chapter, consisting of physical and astronomical observations, he affirms that the sea in the straits of Messina has the appearance of a large inclined speculum; that in the alternate current, or tide, which flows and returns in the straits for six hours each way, and is constantly attended by an opposite current along shore to the medium distance of about a mile and a half, there are many eddies and irregularities at the time of its change of direction: and that the Morgana usually appears at this period. Whence he enters into considerations of the relative situations of the sun and moon, which are necessary to afford high water at the proper time after sun-rise, as before described. It is high water, that is to say, the northern current ceases, at full and change, at nine o'clock. There is probably a small rise and fall, though the annotation to a large chart before me affirms that there is none.

In the fourth chapter, and subsequent part of the work, the author collects the opinion and relations of various writers on this subject; namely, Angelucci, Kircher, Scotus, and others; and he afterwards proceeds to account for the effects, by the supposed inclination of the surface of the sea, and its subdivision into different planes by the contrary eddies. We must refer the reader, however, for further particulars to the work itself.

The account furnished by Mr. Latham to the Philosophical Transactions, of a remarkable *atmospheric refraction*, by which the coast of Picardy became distinctly visible at Hastings, in 1798, we cannot here omit.

'July 26th, about five o'clock in the afternoon,' says this gentleman, 'while sitting in my dining-room at this place (Hastings) which is situated on the parade, close to the sea-shore, nearly fronting the south, my attention was excited by a great number of people running down to the sea-side. On enquiring the reason, I was informed that the coast of France was plainly to be distinguished with the naked eye. I immediately went down to the shore, and was surprised to find that, even without the assistance of a telescope, I could very plainly see the cliffs on the opposite coast; which, at the nearest part, are between forty and fifty miles distant, and are not to be discerned, from that low situation, by the aid of the best glasses. They appeared to be only a few miles off, and seemed to extend for some leagues along the coast. I pursued my walk along the shore to the eastward, close to the water's edge, conversing with the sailors and fishermen on the subject. At first they could not be persuaded of the reality of the appearance; but they soon became so thoroughly convinced, by the cliffs gradually appearing more elevated, and approaching nearer, as it were, that they pointed out, and named to me, the different places they had been accustomed to visit; such as the Bay, the Old Head or Man, the Windmill, &c., at Boulogne; St. Vallery, and other places on the coast of Picardy; which they afterwards confirmed, when they viewed them through their telescopes. Their observations were, that the places appeared as near as if they were sailing, at a small distance, into the harbours.

'Having indulged my curiosity on the shore for nearly an hour, during which the cliffs appeared to be at some times more bright and near, at others more faint and at a greater distance, but never out of sight, I went on the eastern cliff or hill, which is of a very considerable height, when a most beautiful scene presented itself to my view; for I could at once see Dungeness, Dover cliffs, and the French coast, all along from Calais, Boulogne, &c., to St. Vallery; and, as some of the fishermen affirmed, as far to the westward even as Dieppe. By the telescope, the French fishing-boats were plainly to be seen at anchor; and the different colors of the land on the heights, with the buildings, were perfectly discernible. This curious phenomenon continued in the highest splendor till past eight o'clock, though a black cloud totally obscured the face of the sun for some time, when it gradually vanished. I was assured, from every enquiry I could make, that so remarkable an instance of atmospherical refraction had never been witnessed by the oldest inhabitant of Hastings, nor by any of the numerous visitors come to the great annual fair. The day was extremely hot. I had no barometer with me, but suppose the mercury must have been high, as that and the three preceding days were remarkably fine and clear. To the best of my recollection, it was high water at Hastings about two o'clock P. M. Not a breath of wind was stirring the whole of the day; but the small pennons at the mast-heads of the fishing-boats in the harbour were in the morning at all points of the compass. I was, a few days afterwards, at Winchelsea, and at several places along the coast, where I was informed the above phenomenon had been equally visible. When I was on the eastern hill, the cape of land called Dungeness, which extends nearly two miles into the sea, and is about sixteen miles distant from Hastings, in a right line, appeared as if quite close to it; as did the fishing boats and other vessels, which were sailing between the two places; they were likewise magnified to a great degree.'

In another article in the same volume of the Philosophical Transactions (1798), Professor Vince observes, that he remarked a similar apparent approximation of the French coast to that of Ramsgate, in the summer of that year. 'Of two ships,' says he, 'which in different parts were equally sunk below the horizon, the inverted image of one would but just begin to appear, while that of the other would represent nearly the whole of the ship. But this I observed in general, that, as the ship gradually descended below the horizon, more of the image gradually appeared, and it ascended; and the contrary when the ships were ascending. On the horizon, in different parts, one ship would have a complete inverted image; another would have only a partial image; and a third would have no image at all. The images were in general extremely well defined; and frequently appeared as clear and sharp as the ships themselves, and of the same magnitude. Of the ships on this side of the horizon, no phenomena of this kind appeared. There was no fog on our coast; and the ships in the Downs and the South Foreland exhibited no uncommon appearances. The usual refraction at the same time was uncommonly great; for the tide was high, and at the very edge of the water I could see the cliffs at Calais a very considerable height above the horizon; whereas they are frequently not to be seen in clear weather from the high lands about the place. The French coast also appeared, both ways, to a much greater distance than I ever observed it at any other time, particularly towards the east, on which part also the unusual refraction was the strongest.

On the phenomena of *double refraction* Dr. Young has some excellent remarks in his Natural Philosophy, vol. i.

'The atmospherical phenomena,' says he, 'of rainbows and halos present us with examples of the spontaneous separation of colors by refraction. The rainbow is universally attributed to the refraction and reflection of the sun's rays, in the minute drops of falling rain or dew; and the halos, usually appearing in frosty atmospheres, are in all probability produced by the refraction of small triangular or hexagonal crystals of snow. It is only necessary, for the formation of a rainbow, that the sun should shine on a dense cloud, or a shower of rain, in a proper situation; or even on a number of minute drops of water, scattered by a brush or by a syringe, so that the light may reach the eye after having undergone a

certain angular deviation, by means of various refractions and reflections; and the drops so situated must necessarily be found somewhere in a conical surface, of which the eye is the vertex, and must present the appearance of an arch. The light, which is reflected by the external surface of a sphere, is scattered almost equally in all directions, setting aside the difference arising from the greater efficacy of oblique reflection; but when it first enters the drop, and is there reflected by its posterior surface, its deviation never exceeds a certain angle, which depends on the degree of refrangibility, and is, therefore, different for light of different colors: and, the density of the light being the greatest at the angle of greatest deviation, the appearance of a luminous arch is produced by the rays of each color at its appropriate distance. The rays which never enter the drops produce no other effect than to cause a brightness, or haziness, round the sun, where the reflection is the most oblique: those which are once reflected within the drop exhibit the common internal or primary rainbow, at the distance of about 41° from the point opposite to the sun; those which are twice reflected, the external or secondary rainbow, of 52°; and if the effect of the light, three times reflected, were sufficiently powerful, it would appear at the distance of about 42° from the sun. The colors of both rainbows encroach considerably on each other; for each point of the sun may be considered as affording a distinct arch of each color, and the whole disk as producing an arch about half a degree in breadth for each kind of light; so that the arrangement nearly resembles that of the common mixed spectrum. There is, however, another cause of a further mixture of colors: the arch of any single color, which belongs to any point of the sun, is accurately defined on one side only, while on the other it becomes gradually fainter, the breadth of the first minute containing about five times as much light as a minute at the distance of a quarter of a degree: the abrupt termination is on the side of the red, that is, without the inner bow, and within the outer; so that, for this reason, the order of colors partakes, in some degree, of the nature of the red termination of a broad beam of light seen through a prism; but it is more or less affected by this cause, on account of some circumstances, which will be explained when we examine the supernumerary rainbows, which sometimes accompany the bows more commonly observed. A lunar rainbow is much more rarely seen than a solar one, but its colors differ little, except in intensity, from those of the common rainbow.

'In the highest northern latitudes, where the air is commonly loaded with frozen particles, the sun and moon usually appear surrounded by halos, or colored circles, at the distances of about 22° and 46° from their centres; this appearance is also frequently observed in other climates, especially in the colder months, and in the light clouds which float in the highest regions of the air. The halos are usually attended by a horizontal white circle, with brighter spots, or parhelia, near their intersections with this circle, and with portions of inverted arches of various curvatures; the horizontal circle has also sometimes anthelia, or bright spots, nearly opposite to the sun. These phenomena have usually been attributed to the effect of spherical particles of hail, each having a central opaque portion of a certain magnitude, mixed with oblong particles, of a determinate form, and floating with a certain constant obliquity to the horizon. But all these arbitrary suppositions, which were imagined by Huygens, are in themselves extremely complicated and improbable, and are wholly unauthorised by observation. A much simpler, and more natural, as well as more accurate explanation, which was suggested at an earlier period by Mariotte, had long been wholly forgotten, until the same idea occurred to me, without any previous knowledge of what Mariotte had done. The natural tendency of water to crystallise, in freezing, at an angle of 60°, is sufficiently established, to allow us to assume this as the constant angle of the elementary crystals of snow, which are probably either triangular or hexagonal prisms: the deviation produced by such a prism differs very little from the observed angle at which the first circle is usually seen; and all the principal phenomena which attend this circle may be explained, by supposing the axis of the crystals to assume a vertical or a horizontal position, in consequence of the operation of gravity: thus the parhelia, which are sometimes a little more distant from the sun than the halo, are attributed by Mariotte to the refraction of the prisms, which are situated vertically, and produce a greater deviation, on account of the obliquity of the rays of light with respect to their axis. The horizontal circle may be deduced from the reflection, or even the repeated refractions, of the vertical facets; the anthelia from two refractions with an intermediate reflection; and the inverted arch from the increase of the deviation, in the light passing obliquely, through prisms lying in a horizontal position. The external circle may be attributed either to two successive refractions through different prisms, or, with greater probability, as Mr. Cavendish has suggested to me, to the effect of the rectangular terminations of the single crystals. The appearance of colors, in halos, is nearly the same as in rainbows, but less distinct; the red being nearest to the luminary, and the whole halo being externally very ill defined. From the observed magnitude of these halos, I had concluded that the refractive power of ice must be materially less than that of water, although some authors had asserted that this was greater: and Dr. Wollaston afterwards fully confirmed this conclusion, by means of the very accurate instrument which has already been described; his measurement agreeing precisely with the mean of the best observations on these halos, so that ice must be considered as the least refractive of any known substance not aëriform.

'Sometimes the figures of halos and parhelia are so extremely complicated as to defy all attempts to account for the formation of their different parts; but, if we examine the representations which have been given by various authors of the multiplicity of capricious forms frequently assumed by the flakes of snow, we shall see no

reason to think them inadequate to the production of all these appearances.

In his second volume Dr. Young has given an abstract of Dr. Wollaston's observations on the quantity of horizontal refraction. It is as follows:—

'Dr. Wollaston notices Mr. Monge's Memoir on the Mirage, observed in Egypt, as containing facts which fully agree with his own theory formerly published. From his observations on the degree of refraction produced by the air, near the surface of the Thames, it appears that the variations derived from changes of temperature and moisture in the atmosphere are by no means calculable; but that a practical correction may be obtained, which, for nautical uses, may supersede the necessity of such a calculation. Dr. Wollaston first observed an image of an oar at a distance of about a mile, which was evidently caused by refraction, and, when he placed his eye near the water, the lower part of distant objects was hidden, as if by a curvature of the surface. This was at a time when a continuation of hot weather had been succeeded by a colder day, and the water was sensibly warmer than the atmosphere above it. He afterwards procured a telescope, with a plane speculum placed obliquely before its object glass, and provided with a micrometer, for measuring the angular depression of the image of a distant oar, or other oblique object; this was sometimes greater when the object glass was within an inch or two of the water, and sometimes when at the height of a foot or two. The greatest angle observed was somewhat more than nine minutes, when the air was at 50°, and the water at 63°; in general the dryness of the air lessened the effect, probably by producing evaporation; but sometimes the refraction was considerable, notwithstanding the air was dry. Dr. Wollaston has observed but one instance which appeared to encourage the idea, that the solution of water in the atmosphere may diminish its refractive power. In order to correct the error to which nautical observations may be liable, from the depression of the apparent horizon, in consequence of such a refraction, or from its elevation in contrary circumstances; and at the same time to make a proper correction for the dip, Dr. Wollaston recommends that the whole vertical angle, between two opposite points of the horizon, be measured by the back observation, either before or after taking an altitude: and that half its excess above 180° be taken for the dip: or, if there be any doubt respecting the adjustment of the instrument, that it be reversed, so as to measure the angle below the horizon, and that one-fourth of the difference of the two angles, thus determined, be taken as extremely near to the true dip. It is indeed possible that the refraction may be somewhat different at different parts of the surface; but Dr. Wollaston is of opinion that this can rarely happen, except in the neighbourhood of land.'

To these speculations on the optical phenomena of the atmosphere, we may consistently add an abstract of the remarks of professor Hansteen, in the Christiania Journal of Natural History, on the Aurora Borealis and the Polar Fogs. It will be observed that he avails himself of several of the observations of our late navigators in the Polar regions.

'With us,' he says, 'it is well known that the aurora borealis presents itself to view in the following manner:—In the N.N.W. appears a luminous arch, the convex side of which is turned to the zenith, and the extremities of which bend towards the horizon. That part of the circle of the horizon which lies between its extremities forms a chord of the arch. The segment of the circle between the arch and the horizon is, for the most part, darker than the rest of the sky; sometimes black, sometimes dark-gray. The farther you advance towards the north, this colored segment becomes less dark; and, in the highest latitudes, it becomes altogether undistinguishable. The highest point of the arch, at least in latitudes not very high, is almost always found in the magnetic meridian, that vertical plane which passes through the magnetic pole. In the North American States, where the westerly variation of the needle is only two degrees, the same luminous arch is seen, but its highest point lies due north. According to Scoresby's observations on the east coast of Greenland, in lat. 65° N., the arch of the aurora borealis lies from north to south, in such a manner that its highest point is either to the east or west, as the arch lies on the one side or the other of the zenith. This agrees with the remarks of the missionary, Andrew Ginge, on the aurora borealis, in the colony of Good Hope, in Greenland (lat. 64° 10′ 5″); with this difference only, that the arch commonly appears low in the east or south-east, and more seldom approaches near to the zenith. He describes in the following manner such an arch, as seen on the 12th December, 1786. 'At half-past four, P. M., the first faint flashes of the aurora borealis arose from the east, which a quarter of an hour after reached the zenith, and from that shot out on all sides. Soon after, these were converted into an arch, which went through the zenith, and almost touched the horizon in the north and south. This arch was white, and so brilliant that it lighted up Baals River, which is a mile broad. At seven P. M. the declination had decreased, from mid-day, from 50° 57′ to 50° 37′, that is, 20′. At half-past eight the arch disappeared, and in the south was seen a comb with its teeth upwards. At that time the declination was 50° 20′,' &c.

From the foregoing observations, it is easy to see that this arch must be a part of a whole luminous ring, hovering over the surface of the earth at a considerable height, of which every observer sees his own portion. We may give an explanation of this by means of the hour-circle on a globe. Suppose a little insect creeping round the globe in the sixtieth parallel, it will only see a small part of the ring, as the largest portion of it will be concealed by the globe which forms the insect's horizon. The highest part of the arch which in this case it can see will be due north. If it approach nearer to the ring, it will see a larger portion of it; and, when it is close under its edge, this will appear to be in the zenith. If it come nearer the pole, and within the ring, the nearest and highest part of the ring will be seen to the south, just as the

ring of the aurora borealis was seen at Good Hope. Now, were the pole of the earth, or rather a point of its lengthened axis, the centre of the ring of the aurora borealis, the highest point of the arch would be seen every where in the true meridian, or due north. But, as this is not the case, since, with us, the highest point of the arch is seen about 20° west of due north, in North America it is seen due north, and at Good Hope, in Greenland, to the east, it follows that the centre of the ring must lie about from 20° to 30° from the pole of the earth, in a meridian passing through the states of North America. And since the arch is sometimes seen in the zenith near Iceland, and often stretches so far to the south as to pass the zenith, both here, in Christiania and in Copenhagen, and even in more southerly regions, it follows that the radius of the ring of the aurora borealis may extend from 20° to 40° and above. It is easy now to perceive in what manner the arch of the aurora borealis will appear in different meridians. If it be viewed from a point lying in the same meridian with its centre, its highest point will appear due north; and, if this rise so high as to pass through the zenith, its extremities will terminate in the east and west. If, again, it be viewed from a point lying eastward of the meridian of the ring, as with us in Europe, then the highest point of the arch will move to the west of the meridian, and the farther the more you advance to the north, till you come to the same latitude with the centre of the ring, between 60° and 70°. Here the highest point of the arch will lie due west; and, if the ring extend so far as to pass through the observer's zenith, it will go from north to south, that is, it will be parallel with the meridian.

'Such was the case with regard to the arch seen by captain Scoresby on the 15th of April, in lat. 64° 41' If the place of the observer be within the circumference of the ring of the aurora borealis, as is the case with the colonies in the western districts of Greenland, the arch will be seen to the south, provided the observer be south from its centre, and to the east, if he be east from it. These rules may be shortly expressed in the following formula. If the observer be on the outside of the ring of the aurora borealis, he will see the highest point of the arch in the same direction with the centre of the ring: if he be within the ring, the highest point of the arch will be seen in the direction opposite to that of the centre of the ring. That the centre of the ring of the aurora borealis does not coincide with the north pole of the earth is a very remarkable fact. This centre coincides as near as possible with the magnetic pole in North America, the place of which we have determined in the first volume of this Journal (Christiania Mag. of Nat. Hist. p. 19). From this we are led to suppose that there must be some connexion between the aurora borealis and the magnetism of the earth.

'This conjecture is strengthened by the observations of captain Cook with respect to the aurora australis. When that celebrated navigator, on his second voyage, was sailing round the south pole, he often saw, in the southern parts of the Indian Sea, arches of the aurora australis, the highest point of which always lay to the south-east, so long as the ship sailed between the meridian of the Indian peninsula and the parallel of 60°. In that region the variation of the compass is between 30° and 40° W. The highest point of the arch of the aurora australis coincides here too with the direction of the needle. But as soon as he approached the meridian of Van Diemen's Land, where the variation of the compass disappears, the highest point of the arch of the aurora australis was found, too, in the true meridian. From this it appears that the centre of the ring of the aurora australis likewise lies at a considerable distance, from 30° to 40°, from the south pole of the earth, and in a meridian which passes through New Holland. And here, too, we have shown in the first volume, is the south magnetic pole to be found. He afterwards infers, That the polar lights spring from four points on the surface of the earth, which, so far as we have hitherto been able to determine, coincide with the magnetic poles of the earth. The larger luminous ring is formed round the two opposite poles of the stronger magnetic axis in North America and New Holland. Whether a similar ring, as full and as regular, be formed round the poles of the weaker axis, in Siberia and Terra del Fuego, is a matter which, from the few observations which we are able to collect, cannot yet be so well ascertained. The arch of the polar light is seldom seen without luminous beams shooting out from it. From the side of the arch turned away from the pole, beams or rather columns of light dart forth in a direction nearly perpendicular to the arch, and ascend towards the zenith. If these beams are so long as to pass a considerable way beyond the zenith, towards the south, they form, in the neighbourhood of the zenith, a kind of corona or glory, which seems to be the point of their union. This corona lies from 15° to 20° S. of the zenith, in such a situation, that if we suppose a vertical plane passing through the highest point of the arch, which with us lies about 20° W. from the meridian, and produced so as to pass through the zenith, it will come exactly upon the middle of the corona. And it is a very remarkable circumstance, that the distance of this corona from the southern horizon is exactly equal to the inclination of the needle at the place: so that the south pole of the needle points directly to the centre of the corona.

'The *formation* of the corona,' he observes, 'can only be explained by supposing that the luminous columns shoot from the surface of the earth in a direction parallel to the inclination of the needle, and to the direction of the earth's magnetism; that they first become luminous when they pass out of our atmosphere; while, on passing through it, they have the opposite effect of rendering it opaque. By this we can explain the dark segment which appears under the arch; and also this remarkable fact, that, while the aurora borealis is in play, the sky, which is now perfectly transparent, may, in less that a minute of time, be covered with an almost impenetrable veil, which again may vanish in a time as short, —a circumstance which, in our northern regions,

may very unexpectedly derange many an astronomical observation. By this supposition, too, we can explain the dark-colored streaks of the aurora borealis, which I myself have frequently observed, and which are mentioned by several persons who have described these lights in Norway. If we turn the eye towards the magnetic zenith (if I may be allowed to give this name to that point in the heavens to which the higher, or, with us, the southern pole of the needle points), we here see the luminous columns from the end; and, as they are at a considerable distance from one another, in this situation the eye perceives the blue arch of the heavens between them. In all other parts of the sky we see the luminous columns obliquely; so that the one covers the other, which consequently gives them the appearance of beams darting from the arch, connected in one body.

'I have already hinted,' says the professor, 'that there must be some connexion between the aurora borealis and the magnetism of the earth. Besides the reasons which may be derived from the facts already mentioned, I mean, that the centres of the luminous rings coincide with the four magnetic poles; also that the luminous columns shoot parallel to the medium direction of the magnetic powers at any one place; and that they, beyond all doubt, follow the laws of repulsion of the magnetic powers, and, consequently, themselves are magnetic,—there are many other reasons as strong, if not stronger, of which I shall briefly mention only the most important.

'1. When the aurora borealis is vivid, the horizontal magnet becomes restless, varies in a few minutes from three, four, to five degrees from its ordinary place, and sometimes gets into a quivering motion, which shows that, at that time, the magnetic powers of the earth are in a state of great agitation. 2. A short time before the aurora borealis appears, the intensity of the magnetism of the earth is apt to rise to an uncommon height; but so soon as the aurora borealis begins, in proportion as its force increases, the intensity of the magnetism of the earth decreases, recovering its former strength by degrees, often not till the end of twenty-four hours. These changes are sometimes so sudden, that I once observed a considerable difference in the space of from two to three minutes. (The professor here details an experiment made with a fine magnetic needle, suspended by the thread of a silkworm. He counted its vibrations to the amount of 360; and dividing this number into equal portions, and comparing by a chronometer the time occupied by each portion, he found a difference in the number of vibrations performed in the same time, far exceeding any which could arise from the inaccuracy of the observation, proving a difference during the time of the experiment in the intensity of the magnetic force). From this, he says, it seems to follow, that the polar lights are the effect of an uncommonly high magnetic intensity, which intensity lets itself off, as it were, by the polar lights, and thus sinks under its common strength. 3. During the time of a powerful display of the aurora borealis, Mallet and others have found no uncommon strength of electricity in the air, which seems to disprove the hypothesis of Franklin. 4. The Rev. Mr. Steenbuck, who was the editor, and, in a great measure, the author of the Description of the Kingdom of Norway, published under the name of Jessen, and who was himself born in the province of Trondheim, relates, concerning the arch of the aurora borealis, that, according to the accounts of old people, this arch was wont to appear lower on the horizon in Nordland, and nearer to the true north; that, since these times, it has risen higher in the sky, and removed from the meridian towards the west. This agrees entirely with the change of place of the North American magnetic pole, by which it lies somewhat nearer to us, and in a plane which forms a larger angle with the meridian. 5. The Swedish naturalist Wilcke has remarked, that, during a vivid borealis, the corona sometimes changes its place, moving backward and forward several degrees. But, since the place of the corona is determined by the angle formed by the luminous columns with the surface of the earth, it is evident that the angle must likewise change. And, in such cases, he observed, that the inclination of the needle altered in a similar manner, so that, moving up and down, it always pointed to the centre of the corona. A change in the direction of the earth's magnetism produces also a change in the direction of the luminous columns. The perpendicular height of the arch of the aurora borealis above the surface of the earth is to be computed from its height above the horizon, observed at two different places, which lie at a considerable distance from one another, nearly in the same meridian. From a number of those arches, the cotemporaneous height of which was observed at Rome, Paris, Copenhagen, Stockholm, and other places, Mr. Mairan has found, that the ring of the polar lights above the surface of the earth almost always exceeds 100 geographical miles. The luminous columns of which the shooting beams consist have, in all probability, the same height.

'Hudson's Bay and Straits, Baffin's Bay, and the sea around Greenland, are distinguished, in a remarkable manner, by a thick fog, which almost constantly prevails there. Captain Parry suffered much inconvenience from this fog, when he got into Lancaster Sound, and into the straits discovered by him, which he calls Barrow's Straits; and the more on this account that the compass ceased here to have any fixed direction, or, as the sailors say, it wandered. Lieutenant (now captain) Franklin, too, if I remember right, experienced the same thing on his land expedition, along the northern coasts of America on the Polar Sea. Captain William Scoresby's explanation of the origin of this fog seems very admissible, though there may be found other circumstances concurring to the production of the same effect. A similar thick fog prevails likewise in the sea which surrounds Terra del Fuego. I have mentioned already, that Don Antonio de Ulloa says, in his letter to Mairan, that in sailing round cape Horn he found only a few moments when he could obtain a slight glance of the sky. As the same fog is neither so thick nor so constant in other places

of the same latitude, in Behring's Straits, for instance, or south from the Cape of Good Hope, it is not impossible that the streaming of the magnetic power, or of the polar lights, here, too, played their part. It is known by experience that, while these streamers are flowing, the sky has a tendency to become opaque and misty. While the polar lights pass through the air, they must have the effect, in penetrating the watery vapors existing in it in a transparent state, of taking from them their heat, and thereby rendering them opaque. When a solid body passes over into a fluid, or a fluid body into a gaseous state, it acquires a greater quantity of heat; and, in acquiring it, thus robs every surrounding body with which it comes in contact of a part of what they contain. It is thus, in warm climates, they cool vessels by surrounding them with wet cloths; so that the evaporation of the water, in the form of steam, deprives the vessel of a great portion of its heat. In the same manner has nature provided for the cooling of the animal body, in the time of excessive heat, by the increased perspiration, the evaporation of which preserves it in an almost unchanged temperature. Now, as the polar lights are an expansible substance, which in regions surrounding the magnetic poles is continually issuing from the surface of the earth, even at times when we who lie at a distance from these points perceive nothing of this, it may be conceived that this stream, in passing through the atmosphere, is continually lowering its temperature, and thus, in decomposing the watery vapors, producing fog. In this manner, too, may be explained another well-known phenomenon. It might be expected that, in the same parallels, the mean temperature would be every where nearly the same—as the length of the day, and the height of the sun, depend alone on the latitude. But this is by no means the case. In that parallel which passes the sixtieth degree of north latitude, the temperature is the lowest in Hudson's Bay, and at the south point of Greenland. As we approach the coasts of Norway it rises, and in Christiania and Stockholm is about + 5°. In Petersburgh it has begun to descend, and the farther we advance to the east it becomes the lower; so that a Siberian cold has become a proverbial expression. Although Cape Horn lies in the fifty-sixth degree of south latitude, that is about the same latitude with Copenhagen, the cold there is intolerable; and yet at other points of the same parallel it is less. It seems also pretty well proved, that, in one and the same parallel, the mean temperature is least in the meridians which pass through the magnetic poles. Count Humboldt has rendered this distribution of temperatures subject, in a very remarkable manner, to our observation, by connecting, on a chart, all the points where the mean temperature is the same, by a sort of curve lines, which he calls Isothermic Lines. These lines are by no means parallel to the equator, as might be supposed, but remove to the greatest distance from it in the Atlantic Ocean, sinking again both in America and in the eastern hemisphere. Comparing this chart with the lines of the inclination of the needle, in the seventh table of my Magnetismus der Erde, it will be found that these different lines follow very much the same course; a circumstance which is to be explained in this manner: a greater inclination of the needle proves a smaller distance from the magnetic poles, and, consequently, from the place from which the polar lights issue. But, if this meteor has any influence on the temperature, the mean temperature in the same parallel must decrease as the inclination increases; and, consequently, the isothermic lines have the same curvature as the lines of inclination.

'It is a matter of experience perfectly well-known here in the north, which I have found confirmed by the observation of a good many years, that the aurora borealis is generally accompanied by strong biting cold. When a sudden cold succeeds a milder day, it is often accompanied for the first two evenings by the aurora borealis, and likewise by a considerable increase of magnetic intensity. These three phenomena are for the most part contemporaneous; but, where they are not so, experience has taught me, with considerable certainty, to view the one as a near forerunner of the other. The magnetic powers seem thus to act a part in meteorology hitherto unknown. There are, perhaps, various other powers unseen by us, operating in the great chemical laboratory of this globe. The possibility of this ought to teach the prognosticators of the weather some diffidence, when they imagine that, from the situation of the heavenly bodies, or a few circumstances perhaps of little influence, they can foresee its approaching changes; while these are the result of the general powers of the globe, acting from the centre to the surface, and from pole to pole, excited by the light of the sun and moon, and modified in countless ways, by local circumstances of the most different nature. Is it so, then, that the polar lights have a certain connexion with the magnetism of the earth, and the diminution of temperature with the polar lights and a higher magnetic intensity? We are then, perhaps, prepared to explain the seemingly permanent changes of climate in certain northern regions of the globe, if these changes can be actually proved to have taken place. But the accurate observation of temperature by the thermometer is still too recent a discovery, and the range of thermometrical observations in the same place too limited, to enable us to determine this point with absolute certainty. In the mean time, the surrounding of the east coast of Greenland with ice, for a number of ages, is a very remarkable fact. The magnetic pole in North America approaches slowly towards the east; and ought, therefore, if the foregoing possibilities have any reality, in the succession of ages, to surround the northern part of our peninsula with the same barrier, by which it has for ages shut out the east coast of Greenland from all participation in the commotions of Europe. However desirable this might be, in some respects, we cannot help wishing, on other accounts, that this prediction may turn out like other prognostications of the weather.'

Sect. VIII.—Of the Prester or Water-spout.

Gassendi contended that the prester of the ancients was a mere tornado or whirlwind; but

this was before the nature, or even the existence, of electricity, as a definite power, had been accurately ascertained; and to prove that this is an error, it is only necessary to quote the description of the prester, as given by Lucretius, and to follow up the quotation with the explanation of his translator, Dr. Good, by which it will abundantly appear that the prester, like the spout of the present day, was regarded as both a sea and land meteor, or in other words as filled with water, and without water; the term being more properly applied to the former, and the latter being correctly regarded and called a mimic, or imitative prester; in reality the fiery whirlwind or hurricane.

The passage we advert to is as follows: lib. vi. 422.

Quod super est, facul est ex hiis cognoscere rebus,
Πρηστηρας Graiei quos ab re nominitarunt,
In mare quâ missei veniant ratione superne.—&c. &c.

Hence, with much ease, the meteor may we trace
Termed, from its essence, PRESTER by the GREEKS,
That oft from heaven wide hovers o'er the deep,
Like a vast column, gradual from the skies,
Prone o'er the waves, descends it; the vext tide
Boiling amain beneath its mighty whirl,
And with destruction sure the stoutest ship
Threat'ning that dares the boist'rous scene approach.
Thus solve th' appearance; that the maniac wind,
In cloud tempestuous pent, when unempower'd
To burst its bondage, oft the cloud itself
Stretches cylindric, like a spiral tube
From heaven forced gradual downwards to the deep;
As though some viewless hand, its frame transpierced,
With outspread palm had thrust it from above.
This, when at length, the captived tempest rends,
Forth flies it, fiery, o'er the main, and high
Boils from its base th' exaggerated tide.
For, as the cone descends, from every point
A dread tornado lashes it without,
In gyre perpetual, through its total fall:
Till, ocean gained, the congregated storm
Gives its full fury to th' uplifted waves,
Tortured and torn, loud howling midst the fray.
Oft, too, the whirlwind from the clouds around
Fritters some fragments, and itself involves
Deep in a cloudy pellicle, and close
Mimics the prester, lengthening slow from heaven;
Till, earth attained, th' involving web abrupt
Bursts, and the whirlwind vomits and the storm.
Yet, as on earth the mountains' pointed tops
Break oft the texture, tubes like these, at land
Far rarer form than o'er the marble main.

The translator's note upon this passage, in exposition of his author, is as follows, and we give it as affording a clear explanation of the nature and properties of this singular meteor:—

'Having discussed the phenomenon of thunder and lightning, he now proceeds to consider those of the water-spout, and the hurricane; and it is truly curious to observe how minutely he concurs with the philosophy of the present day, in regarding them as meteors of a similar nature and origin. Prester, indeed, as our poet informs us, is a Greek word, signifying a fiery or inflammatory intumescence; and such, he asserts, is the essence of which this meteor (the water-spout) consists: whence it is obvious that the term ventus, or wind, applied to it immediately afterwards, is employed generically, to express an elastic gas or ether, for which Lucretius found no definite expression in his own language, rather than the nature of wind properly so called. It is an igneous or fiery aura, not indeed in the open act of combustion, but composed of the finest and most minute particles of a peculiar species of elementary fire, which, in a more concentrated form, would necessarily become luminous and burning.

'Gassendi, indeed, contends, that the Epicurean prester is not an igneous meteor, but a mere vortex of elastic air. But there can be no doubt of his being mistaken; for Lucretius not only employs a term to which fire, in some modification or other, either elementary or combined, is necessarily attached, but refers us in the opening of the discussion, by way of explanation, to the constituent particles of lightning, which, he expressly declares, consist of the very finest and most attenuate fiery atoms.

'Fiery, too, and of the common essence of lightning, is this meteor asserted to be, by the philosophy of the present day. For it is regarded as an electrical phenomenon, as, indeed, is almost every atmospherical meteor, as well as a great variety that are subterraneous. In describing the powers and operation of the thunder-cloud, in note on v. 256 above, I have noticed its wonderful faculty of attracting, with almost instantaneous speed, the lighter and adscititious clouds in its vicinity, as I have also its submission to the still more strongly attractive power of that part of the earth which lies immediately beneath it, in a state of negative electricity, evidenced by its dipping downwards either in ragged and multiform fragments, or, where the film of the cloud is tenser, in more regular and unbroken protuberances. Retaining then these simple facts in our recollection, it will not be difficult to account for the phenomenon of the prester, or water-spout, upon the principles of the electric theory.

'A thunder-cloud, or cloud filled with electric matter, is first noticed to appear at sea in a sky so serene as to be totally destitute of adscititious clouds, and in an atmosphere so dry as to be possessed of very little and impalpable vapor. Such is the general appearance of the horizon on the commencement of the water-spout. In such a situation a thunder-storm cannot be the result, for want of the confederate assistance of additional clouds and vapors: but, from the circumstances enumerated above, a very considerable portion of mutual attraction must take place between this isolated cloud, and the portion of the sea immediately beneath it, more especially if the sea be at this time negatively electrified, or destitute of the electric power of which the cloud has a vast surplus. From this mutual attraction, the water directly under the cloud will become protuberant upwards, rising like a hill towards the cloud above, which, in the phenomenon we are now describing, it always does, and the cloud above will become protuberant downwards, elongating itself towards the elevated portion of water beneath. If, in this action of straining, the texture of the cloud be very slight, it will burst into a thousand fragments, and the electric matter contained within it will

METEOROLOGY.

Fig. 1

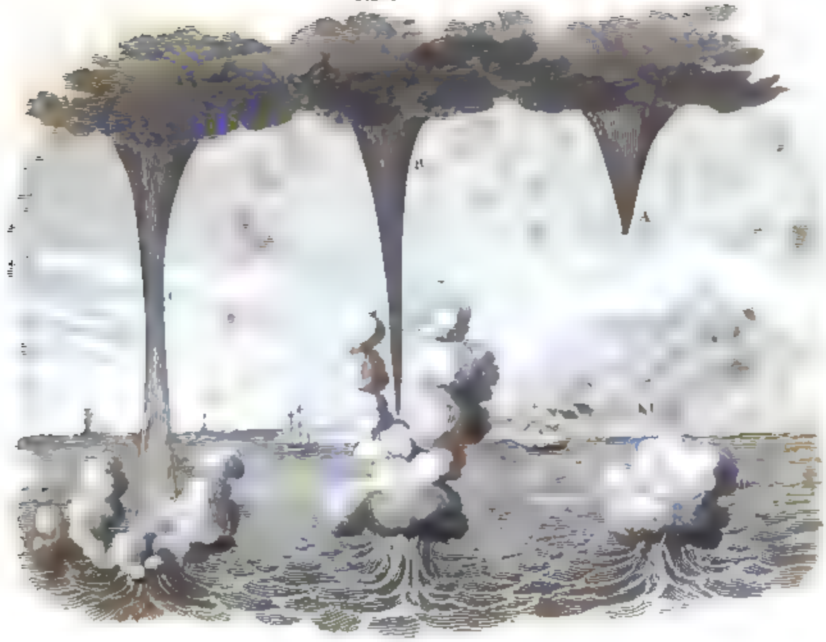


Fig. 2

WATER SPOUT SEEN NEAR THE LIPARI ISLANDS

London Published by Thomas Tegg 73 Cheapside.

J. Shury sculp

be quietly dissipated, or attracted to the ocean; but, if it be stronger and more viscous, it will continue to stretch without bursting; and, like every other elastic substance, the more it stretches, the narrower will be the projected tube. Such, to the mariner, is the actual apperance of the column of the water-spout, precisely resembling a speaking trumpet, with its base or broader part uppermost. When the mouth of this projected tube touches the rising hillock of water, if the attraction of the negatively electrified ocean be superior, the electric aura, we may naturally suppose, will be drawn downwards, and the empty cloud be totally dissipated; but, as will generally occur in the case of a positive force applied to a negative, if the attraction of the electric cloud prove victorious, it will continue to suck up the rising hillock of water till it is altogether sated, and can hold no more. At this time the cloud must necessarily burst from its own weight and distention, and in proportion to its size, and the deluge of water and electricity it discharges, will be the mischief produced. It is said that it may occasionally be rent, at a distance, by making a violent noise on board the ship in which it is perceived by files, saws, or other discordant instruments; and, certainly, whatever will tend to agitate the air in any considerable degree, affords some prospect of breaking the cloudy film, and thus dispersing the meteor; but the more ordinary method of shooting at it from guns of a large calibre, gives a much stronger, and, indeed, almost certain chance of success; for no mechanical power can agitate the surrounding atmosphere by any means so forcibly as the report of a large cannon; and, if it be loaded with ball, it will give a double prospect of discharging the contents of this tremendous spectacle.'

Upon that part of the description which relates to the mimic prester, Dr. Good observes as follows: 'Lucretius here alludes to meteors of a similar description, but not quite so tremendous in their effect: and is generally supposed to refer to the hurricane, or, as the Greeks termed it, εκνεφια; which is equally an electrical phenomenon, and may be regarded as a prester occurring on land, and consequently as an electric cloud filled with elastic air only, or other vapors received from the atmosphere, and not often with water. It is produced in the same manner as the sea-prester, has the same kind of elongated tube reaching towards the negatively electrified portion of the earth by which it is attracted, and is accompanied, previous to its bursting, by a similar tornado of external air. This elongated tube, as well as the substance of the cloud itself, in the time of Shakspeare, was supposed to have its film or fibres condensed and rendered firmer by the operation of the rays of the sun; but there is no necessity for such an idea:—

——the dreadful spout
Which shipmen do the hurricano call,
Constringed in mass by the almighty sun.
Troilus and Cressida.

'We may account for the phenomenon in this manner: that the thirsty cloud, in consequence of a more elevated position than ordinary in the atmosphere, at the time it commences its attraction with the water below, satiates and distends itself, by means of its proboscis, with absorbed air alone, prior to the actual contact of such proboscis with the hillock of rising water; so that, by the time this elongating spout extends to the attracted hillock, it is totally incapable of containing any thing farther.'

Cavallo supposes that electricity is rather a consequence than a cause of water-spouts; and notices that they sometimes vanish and reappear. Dr. Franklin conceived that a vacuum is made by the rotatory motion of the ascending air, as when water is running through a tunnel, and that the water of the sea is thus raised. But it is justly observed, by Dr. Young, that no such cause as this could do more than produce a slight rarefication of the air, much less raise the water to above thirty or forty feet. At the same time the force of the wind thus excited might carry up much water in detached drops, as it is really observed to exist in water-spouts. Dr. Young remarks moreover, in another passage, that the phenomena of water-spouts, if not of electrical origin, appear to have some connexion with electrical causes. A water-spout generally consists of large drops, like a dense rain, much agitated, and descending or ascending with a spiral motion, at the same time that the whole spout is carried along horizontally, accompanied in general by a sound like that of the dashing of waves. Spouts are sometimes, although rarely, observed on shore, but generally in the neighbourhood of water. They are commonly largest above; sometimes two cones project, the one from a cloud, the other from the sea below it, to meet each other, the junction being accompanied by a flash of lightning: and, when the whole spout has exhibited a luminous appearance, it has perhaps served to conduct electricity slowly from the clouds to the earth. Some of these circumstances may be explained by considering the spout as a whirlwind, carrying up drops of water, which it has separated from the surface of the waves; and the remainder may perhaps be deduced from the co-operation of electricity, already existing in a neighbouring cloud.

One of the best accounts of the appearance of the genuine prester is given by Mr. Maxwell in the Edinburgh Philosophical Journal.

During several voyages to Congo, he frequently witnessed this interesting phenomenon; and in a drawing in his Journal, from which fig. 1 of our plate METEOROLOGY is copied after the Edinburgh Philosophical Journal, he has represented the different states of a water-spout, as they most commonly occur.

'At their first formation they appear,' he says, 'as at A, where the black cloud drops from a level surface into a conical form, before the disturbance at the surface of the sea, as shown at D, is observed. The effect produced at D is like that of a smoking furnace. The black conical cloud now continues to descend, as shown at B, till it almost reaches the surface of the sea, and the smoke-like appearance rises higher and higher till it forms a union with the cloud from which the spout appears to be suspended. In this si-

tuation it is said to put on its most terrific appearance to the mariners who have the misfortune to be in its neighbourhood. When the spout begins to disperse it assumes the appearance shown at C. The black cloud generally draws itself up in a ragged form, but leaves a thin transparent tube C E, which reaches to the water where the smoke-like commotion still prevails. Mr. Maxwell observed at this time in the upper part of the tube a very curious motion.'

This fact, of the existence of a transparent tube, confirms Mr. Alexander Stewart's description in the Philosophical Transactions, of the water-spouts which he saw in the Mediterranean in 1701. 'It was observable of all of them,' says he, 'but chiefly of the large pillar, that towards the end it began to appear like a hollow canal, only black in the borders, but white in the middle; and, though at first it was altogether black and opaque, yet one could very distinctly perceive the sea-water to fly up along the middle of this canal as smoke does up a chimney, and that with great swiftness, and a very perceptible motion; and then, soon after, the spout or canal burst in the middle, and disappeared by little and little; the boiling up and pillar-like form of the sea water continuing always the last, even for some considerable time after the spout disappeared, and perhaps till the spout appeared again, or reformed itself, which it commonly did in the same place as before, breaking and forming itself again several times in a quarter or half an hour.' --Philosophical Transactions 1702, p. 1077.

We copy the following from the Journal of the Royal Institution.

Extract of a letter from William Ricketts, esq. Captain in the Royal Navy, to the Right Hon. Sir Joseph Banks, Bart. &c. &c.

In the month of July, 1800, captain Ricketts was suddenly called on deck, on account of the rapid approach of a water-spout among the Lipari Islands; it had the appearance of a viscid fluid, tapering in its descent, proceeding from the cloud to join the sea; it moved at the rate of about two miles an hour, with a loud sound of rain; it passed the stern of the ship, and wetted the after-part of the mainsail; hence captain Ricketts concluded that water-spouts were not continuous columns of water; and subsequent observations confirmed the opinion. See plate METEOROLOGY, fig. 2.

In November, 1801, about twenty miles from Trieste, a water-spout was seen eight miles to the southward; round its lower extremity was a mist, about twelve feet high, nearly of the form of an Ionian capital, with very large volutes, the spout resting obliquely on its crown. At some distance from this spout the sea began to be agitated, and a mist rose to the height of about four feet: then a projection descended from the black cloud which was impending, and met the ascending mist about twenty feet above the sea; the last ten yards of the distance were described with a very great rapidity. A cloud of a light color appeared to ascend in this spout like quicksilver in a glass tube. The first spout then snapped at about one-third of its height, the inferior part subsiding gradually, and the superior curling upwards.

Several other projections from the cloud appeared, with corresponding agitations of the water below, but not always in spouts vertically under them: seven spouts in all were formed; two other projections were re-absorbed. Some of the spouts were not only oblique but curved: the ascending cloud moved most rapidly in those which were vertical; they lasted from three to five minutes, and their dissipation was attended by no fall of rain. For some days before, the weather had been very rainy with a south-easterly wind; but no rain had fallen on the day of observation.

The mimic or false prester, with little or no water, is a curious vagary of nature. On the 15th of August, 1617, there was observed by the Rev. Abraham De la Pryme, F. R. S., about two o'clock in the afternoon, a water-spout in the air, at Hatfield, in Yorkshire. 'It was about a mile off, coming directly to the place where I was,' says this gentleman, 'upon which I took my perspective glasses, and made the best observations on it I could.

'The season was very dry, the weather extremely hot, the air very cloudy, and the wind pretty strong, and what was remarkable blowing out of several quarters at the same time, and filling the air with thick and black clouds, in layers; this blowing of the wind soon created a great vortex, gyration, and whirling among the clouds, the centre of which now and then dropt down in the shape of a thick long black tube, commonly called a spout; in which I could distinctly see a motion, like that of a screw, continually drawing upwards, and screwing up as it were whatever it touched. In its progress it moved slowly over a hedge row and grove of young trees, which it made bend like hazel wands, in a circular motion; then, advancing forward to a large barn, in a moment it plucked off all the thatch, and filled the whole air with it. Coming to a very large oak tree, it made it bend like the former, and broke off one of its strongest branches, and, twisting it about, flung it to a very considerable distance off. Then coming near the place where I stood, within 300 yards of me, I beheld with great satisfaction this extraordinary phenomenon, and found that it proceeded from a gyration of the clouds, by contrary winds meeting in a point or centre; and, where the greatest condensation and gravitation was, falling down into a large pipe or tube, somewhat like the cochlea Archimedis; and which, in its working or whirling motion, either sucks up water, or destroys ships, &c. Having proceeded about a quarter of a mile farther, it was dissolved by the prevalency of the wind from the east.' *Philosophical Transactions* 1702.

May the 5th, 1752, a similar phenomenon appeared about seven in the evening, in Deeping-Fen, which, from its effects, seemed to be a water-spout, broken from the clouds. A watery substance, as it seemed, was seen moving on the surface of the earth and water, in Deeping-Fen. It passed along with such violence and rapidity, that it carried every thing before it, such as grass, straw, and stubble; and, in going over the coun

try bank, it raised the dust to a great height; and when it arrived in the Wash, in the midst of the water, and just over against where Mr. R. lived, it stood still for some minutes. This watery substance spouted out water from its own surface to a considerable height, and with a terrible noise. On its second route it proceeded in a side line into a river, breaking in its passage a fishing net, and there moved along, till it came to the church, where it again stood a little while, and then made its next passage through the space between the church and the parsonage-house, towards Weston Hills and Moulton Chapel. In its way to these places it tore up a field of turnips, broke a gate off its hinges, and another into pieces. Those who saw it evaporate, affirm it ascended into the clouds in a long spearing vapor, and at last ended in a fiery stream. There was a mist like smoke frequently round it. Three more were seen at the same time in different places.—*Id.* 1751.

We subjoin the following as the most modern and amongst the most able accounts of the water-spout from Dr. Brewster's Journal. It is part of a letter from captain Napier, R. N., to that gentleman, dated 17th July 1821. 'I take the liberty of offering you the following observations, with the remarks made at the time, when the facts and appearances exhibited by this extraordinary phenomenon were deeply impressed upon my mind. On the 6th of September 1814, in lat. 30° 47′ N., and long. per chronometer 62° 40′ W., at 1*h*. 30*m*. P. M., the wind being variable between W. N. W. and N. N. E., the ship steering south-east, an extraordinary sort of whirlwind was observed to form about three cables length from the starboard bow of H. M. S. Erne. It carried the water up along with it in a cylindrical form, in diameter to appearance like that of a water-butt, gradually rising in height, increasing in bulk, advancing in a southerly direction, and, when at the distance of a mile from the ship, it continued stationary for several minutes, boiling and foaming at the base, discharging an immense column of water, with a rushing or hissing noise, into the overhanging clouds; turning itself with a quick spiral motion, constantly bending and straightening, according as it was affected by the variable winds which now prevailed alternately from all points of the compass. It next returned to the northward in direct opposition to the then prevailing wind, and right upon the ship's starboard beam, whose course was altered to east, in hopes of letting it pass a-stern. Its approach however was so rapid, that we were obliged to resort to the usual expedient of a broadside, for the purpose of averting any danger that might be apprehended, when, after firing several shots, and one, in particular, having passed right through it at the distance of one-third from its base, it appeared for a minute as if cut horizontally in two parts, the divisions waving to and fro in different directions, as agitated by opposite winds, till they again joined for a time, and at last dissipated in an immense dark cloud or shower of rain. The near edge showered in large heavy drops on the ship's deck, until the cloud was quite exhausted.

'At the time of its being separated by the effect of the shot, or more probably by the agitation occasioned in the air by the discharge of several guns, its base was considerably within half a mile of the ship, covering a portion of the surface of the water, at least half a furlong, or even 300 feet in diameter, from one extreme circumference of ebullition to the other, and the neck of the cloud into which it discharged itself appeared to have an altitude of 40° of the quadrant, while the cloud itself extended over-head, and all round to a very considerable distance. Allowing, then, from the ship, a base of a little more than one-third of a nautical mile, say 2050 feet, and an angle of 40° to the top of the neck, we shall then have, for the perpendicular height of the spout, about 1720 feet, or very nearly one-third of a statute mile. A little before it burst, two other water-spouts, of an inferior size, were observed to the southward, but their continuance was of short duration. When danger was no longer to be apprehended, I observed the barometer, and found it at 30$\frac{1}{10}$ inches, with the surface of the mercury very convex, an appearance which it had not assumed when at the same height at noon, about two hours before; the thermometer stood at 82°, having risen 1° since that time.

'During the continuance of the water-spout, and the subsequent rain, which might be a little more than half an hour, the wind blew from all points of the compass at different times, generally shifting at opposite points, never stronger than a fresh breeze for a moment, but in most instances quite light. It was unattended with any thunder or lightning, and the water that fell from the cloud, and was caught in the foot of the driver, was perfectly fresh.

'Having witnessed this extraordinary phenomenon, I endeavored to ascertain its cause, taking for granted the following axioms:—1. 'That water in a vacuum rises only to the height of thirty-two feet,' or, in other words, 'that a column of water thirty-two feet high is equal in weight to a column of the atmosphere of the same base.' 2. 'That a column of mercury twenty-nine inches high, in vacuo, is equal to the same.' 3. 'That heat rarifies the air and causes a vacuum.' 4. 'That when, the lower atmosphere is so much rarified as to become lighter than the impending clouds, then these clouds or vapors fall and disperse on the surface of the earth in the shape of rain or moisture.' 5. 'That, when the clouds descend, the mercury in the barometer also descends, and that when the vapors rise through the lower atmospheres, becoming again more dense than the vapors themselves, the mercury in the barometer rises also.' With these data, were next noted the various phenomena, as observed to be connected with the water-spout itself.

'1. Low, heavy, black clouds were seen to the southward at noon, the barometer standing at 30$\frac{1}{10}$ inches, and the thermometer at 81°, in a constant current of cool air; the atmosphere, in general, becoming hazy, even thick in some places, close and very hot,—the wind variable and attended with occasional drops of rain. A whirlwind next taking place, drawing the water up with it, apparently in a state like vapor or steam, advancing in a southerly direction to the above-

mentioned dark impending clouds, increasing also in height and bulk, with a quick spiral motion, till it came in contact with the end of a cloud which rather drooped to meet it; then discharging great quantities of water, not in a solid bulk, but in short unconnected streams or streaks as it were, attended with a rushing or hissing noise. 2. That after some time it returned with considerable velocity to the northward, in opposition to the wind prevailing at the ship, the water at the base boiling with a white foam, part projecting outwards to a certain circumference, and part arising in thick dark vapors, which gradually arranged themselves into thin streaks, as they gained in ascent towards the clouds, till the whole was dispersed by bursting into a heavy shower. 3. That the clouds descended, or came gradually nearer to the surface of the sea, before they were perfectly saturated, previous to bursting. 4. That these clouds extended in large dark masses over a great part of the western hemisphere, and were quite thick and dark over-head. 5. That the water-spout, at the base, covered, in diameter, about half a furlong of water; and in its most slender part, about two-thirds upwards, it was to appearance about six feet in diameter; and that, in height, it might be estimated at 1700 feet: and, lastly, that during the operation of these extraordinary phenomena in the atmosphere, the mercury in the barometer did only become more convex than before, with the thermometer rising 1°.

'In proceeding to examine the subject, we shall suppose that the water rose from the sea in vacuo, or rather in a cylindrical space approximating to that of a vacuum, and that it was caused so to rise, in part, by the pressure of the atmosphere circumscribing the base of the said vacuum. Having allowed so much, we can go no further without violating the well-known law, that 'water cannot rise in vacuo' above thirty-two feet; admitting, therefore, that it was even assisted to that small height, we shall have availed ourselves of the theory, as far as truth or reason can justify. If we say that water is drawn upwards by the suction of a cloud, as proposed to be exemplified by Mr. Oliver with a quill over a glass of water, we shall then begin to establish the theory of 'suction,' perfectly irreconcileable, also, with the equally well-known fact of the gravity of the atmosphere. Besides, the force of Mr. Oliver's lungs, over a glass of water, can bear no analogy to that of a cloud overhanging the surface of the sea. It appears also strange to talk of an empty cloud, or a half exhausted cloud, for clouds are not aerial bags, as some would have them to be, but vapors overhanging the earth at different heights from it, according to the proportion of humidity or density contained in themselves, and which, when, by reason of their greater weight, they fall within the sphere of the earth's attraction, begin to discharge themselves in rain, till, being reduced in size and density, if not totally consumed, they naturally rise above the sphere of attraction, and, regaining the higher parts of the atmosphere, again attract each other, and repeat such operations to the end of time.

'Setting aside, then, the theory of suction, and the idea that the water-spout could rise in a body to the clouds, by the pressure of the circumambient atmosphere alone, we shall have the following probabilities to bring us to a more rational conclusion. 1st, That many opposite currents of wind, all pointing towards a certain centre, and coming in contact with each other with unequal forces, cause a rotatory motion or current of themselves round a central space, which, not partaking of an equal or its former pressure, naturally becomes rarified by the existing heat, to such an extent, that it speedily acquires a state in a great degree approximating to that of a vacuum. 2dly, This continued rotatory motion of the air forms that which is usually denominated a whirlwind; and the pressure of the external atmosphere at the base, forcing the water to a reasonable height up the rarified space within, it is then carried upwards by the mechanical action of the wind in light and unconnected streaks. The space at the bottom, now becoming void, is regularly replenished by the pressure from without, till the whole spout is in due time thus perfectly completed.

'The water having now arrived at the region of the clouds, it is naturally attracted, diffused and connected with and among them, increasing in density and extent, till the lower atmosphere becoming now lighter than the clouds above, these enormous masses gradually settling downwards, distend, burst and dissipate in rain. That the mercury in the barometer did not fall with the rain, but, on the contrary, became considerably more convex, was visible from observation and may be accounted for in the following manner:—That during the whole operation of the water-spout, which continued not more than thirty minutes, the commencement was too sudden, and the duration too short, to cause any change indicative of what actually took place; and that this convexity only prognosticated what would have taken place, had there been no water-spout at all, and what actually did happen afterwards, viz. a very clear atmosphere and hot sultry weather.

'Although this phenomenon was rather terrific in appearance, yet I am not inclined to think it would have been attended with any serious calamity to the ship, had even the whole quantity fallen on board, allowing the loftier sails to have been taken in, the hatches battened down, and scuppers open. The cylinder or spout, coming in contact with the masts and rigging, would naturally be destroyed; and, the air rushing in instantaneously to restore the equilibrium, the torrent would be thus checked in its fall to the mere weight or force of a tropical descent. I have heard many reports of ravages committed by these aqueous meteors, but never yet met a person who had actually witnessed or experienced any such distressing effects. Upon comparing the present account with that of Mr. Maxwell's, illustrated by a very striking representation, it appears that, when completed, the two spouts are almost perfectly alike, but originally had derived their first formation from different sources. The cause of the whirlwind must be the same in all cases.

'Mr. Maxwell distinctly states, 'that, at the first formation, the black cloud drops from a

level surface into a conical form, before the disturbance at the surface of the sea is visible. The black conical cloud continues to descend till it almost reaches the surface of the sea, and the smoke-like appearance at the surface rises higher and higher, till it forms a union with the cloud from which that spout appeared to be suspended.' In this instance, the whirlwind must have commenced, and been complete, sooner in the region of the clouds than at the surface of the sea, and thus attracted and brought down with it all those vapors that first came within its influence, meeting in its descent a portion of water, of a 'smoke-like appearance,' rising from the sea itself, contained, of course, within the vacuum there more recently completed.

'This appears just as probable as that the whirlwind and spout should have commenced first at the surface of the sea, and then risen upwards, as in the other instance; for it has been seen that this spout traversed a considerable distance to the southward, before it came in contact with a cloud, which 'rather drooped to meet it.' In both instances, however, the clouds and sea were connected by a long column of water, but the latter, having had its origin at the sea, increased to a much greater bulk, even to the formation of clouds themselves; whereas the former, having originated aloft, acted merely as a canal or duct, through which the clouds discharged themselves into the ocean below. In the case given by Mr. Maxwell the spout must have been of smaller dimensions, and a less terrific appearance than the subject of the present paper, and from the very obvious cause of its having originated aloft instead of below. In the formation of whirlwinds there can be no fixed or determinate rule, why a preference should be given to their being generated at any one particular altitude between the clouds and sea, in preference to another; and if we take it for granted that they are essential to the formation of water-spouts, or that a spout cannot exist without a previous whirlwind, it then naturally follows, that the dimensions of such a spout must, in a very great measure, depend upon the original proximity of the whirlwind to the sea itself, the sea affording a more copious supply of aqueous material, than the less substantial fabric of a cloud. The water that fell into the foot of the driver, on board the Erne, was certainly quite fresh to the taste, and it will be difficult to ascertain when and where the process of distillation was effected. In the mean time, however, it may reasonably be admitted, that the admixture of the salt-water from the sea, with the fresh-water in the clouds, the latter being in far greater proportion than the former, is of itself sufficient to account for the chemical change that had thus taken place in so short a space of time.

'Whenever we are better acquainted with the effect of coming in actual contact with one of these giants of the deep, we shall then be enabled to comply with the recommendations inserted at the end of Mr. Maxwell's paper; but as there does exist at present, in the minds of all seamen, a most indescribable aversion to any intentional familiarity with meteors of such doubtful tendency, it may be difficult to find one who shall court a closer acquaintance for the mere purpose of science, in preference to the usual employment of every individual exertion of getting out of the way as fast as possible. In case of the ship's being becalmed, and every thing secured, and when one cannot do better, as was very much the case on board the Erne, it would be well to make every possible remark and observation, but such opportunities are said to be of very rare occurrence.'

Sect. IX.—Of Meteoric Stones.

These remarkable productions of the atmosphere, usually descending after the explosion of some of its heterogeneous compounds, have excited human attention in all ages. Yet as late as the year 1769 the French Academy of Sciences asserted their falling from the atmosphere to be impossible. The Chinese have only pushed their philosophy to the opposite pole of absurdity by considering them to be connected with contemporary events. Yet the oriental has been, as it was likely to be, the less injurious error to science; for it has led that wonderful people to preserve extensive catalogues of meteoric stones.

'While all Europe,' says the celebrated Vauquelin, 'resounded with the rumor of stones fallen from the heavens; and while philosophers, distracted in opinion, were framing hypotheses to explain their origin, each according to his own fancy, the honorable Mr. Howard, an able English chemist, was pursuing in silence the only route which could lead to a solution of the problem. He collected specimens of stones which had fallen at different times, procured as much information as possible respecting them, compared the physical or exterior characters of these bodies; and even did more, in subjecting them to chemical analysis, by means as ingenious as exact. It results from his researches that the stones which fell in England, in Italy, in Germany, in the East Indies, and in other places, have all such a perfect resemblance, that it is almost impossible to distinguish them from each other; and what renders the similitude more perfect and more striking is, that they are composed of the same principles, and nearly in the some proportions.'

'I should have abstained,' continues he, 'from any public notice of an object, which has been treated of in so able a manner by the English chemist, if he himself had not induced me to do so, during his residence in Paris; had not the stones which I analysed been from another country; and had not the interest excited by the subject rendered this repetition excusable. It is therefore to gratify Mr. Howard; to give, if possible, more weight to his experiments; and to enable philosophers to place full confidence in them, rather than to offer any thing new, that I publish this memoir.' *Journal des Mines*, No. 76; and *Tilloch's Mag.* vol. xv. p. 346

'It is remarkable,' says Dr. Ure, 'that all the stones, at whatever period, or in whatever part of the world they may have fallen, have appeared, as far as they have been examined, to consist of the same substances; and to have nothing similar to them, not only among the minerals in the neighbourhood of the places

where they were found, but among all that have hitherto been discovered in our earth, as far as men have been able to penetrate. For the chemical analysis of a considerable number of specimens we are particularly indebted to Mr. Howard, as well as to Klaproth and Vauquelin; and a precise mineralogical description of them has been given by the count de Bournon and others. They are all covered with a thin crust of a deep black color, they are without gloss, and their surface is roughened with small asperities. Internally they are grayish, and of a granulated texture, more or less fine. Four different substances are interspersed among their textures, easily distinguished by a lens. The most abundant is from the size of a pin's head to that of a pea, opaque, with a little lustre like that of enamel, of a gray color, sometimes inclined to brown, and hard enough to give faint sparks with steel. Another is a martial pyrites, of a reddish-yellow color, black when powdered, not very firm in its texture, and not attractible by the magnet. A third consists of small particles of iron in a perfectly metallic state, which give to the mass the quality of being attracted by the magnet, though in some specimens they do not exceed two per cent. of the whole weight, while in others they extend to a fourth. These are connected together by a fourth of an earthy consistence in most, so that they may be broken to pieces by the fingers with more or less difficulty. The black crust is hard enough to emit sparks with steel, but may be broken by a stroke with a hammer, and appears to possess the properties of the very attractible black oxide of iron. Their specific gravity varies from 3·352 to 4·281. The crust appears to contain nickel united with iron, but Mr. Hatchett could not determine its proportion. The pyrites he estimates at iron ·68, sulphur ·13, nickel ·06, extraneous earthy matter ·13. In the metallic particles disseminated through the mass, the nickel was in the proportion of one part, or thereabout, to three of iron. The hard separate bodies gave silex ·50, magnesia ·15, oxide of iron ·34, oxide of nickel ·025; and the cement, or matrix, silex ·48, magnesia ·18, oxide of iron ·34, oxide of nickel ·025. The increase of weight in both these arose from the higher oxidation of the iron. These proportions are taken from the stones that fell at Benares on the 19th of December, 1798. M. G. Rose of Berlin has succeeded in separating crystals of pyroxene from a large specimen of the aërolite of Juvenas, and has measured the angles with the reflective goniometer; one of the crystals is of the octohedral variety, represented in the 109th figure of Haüy's Mineralogy. The same rocky tissue contains microscope hemitrope crystals, which appear to be felspar, with a base of soda, i. e. albite. In the aërolite of Pallus the olivine is perfectly crystallised. The solitary masses of native iron that have been found in Siberia, Bohemia, Senegal, and South America, likewise agree in the circumstance of being an alloy of iron and nickel; and are either of a cellular texture, or have earthy matter disseminated among the metal. Hence a similiar origin has been ascribed to them.

'Laugier, and afterwards Thenard, found chrome likewise, in the proportion of about one per cent., in different meteoric stones they examined. In all the instances in which these stones have been supposed to fall from the clouds, and of which any perfect account has been given, the appearance of a luminous meteor, exploding with loud noise, has immediately preceded, and hence has been looked to as the cause. The stones likewise have been more or less hot, when found immediately after their supposed fall. Different opinions, however, have been entertained on this subject, which is certainly involved in much difficulty. Some have supposed them to be merely projected from volcanoes; while others have suggested, that they might be thrown from the moon; or be bodies wandering through space, and at length brought within the sphere of attraction of our planet.

'Various lists of the periods, places, and appearances of these showers of stony and earthy matters, have been given from time in the scientific journals. The latest and most complete is that published in the first volume of the Ed. Phil. Journ. compiled partly from a printed list by Chladni, and partly from a manuscript one of Mr. Allan, read some years ago at the Royal Society of Edinburgh. It appears that Domenico Troili, a Jesuit, published at Modena, in 1766, a work entitled Della Caduta di un Sasso dall Aria, ragionamento, in which the ingenious author proves, in the clearest manner, both from ancient and modern history, that stones had repeatedly fallen from the heavens. This curious dissertation (ragionamento) is in the possession of Mr. Allan. The compiler of the new list justly observes, that nothing can show more strikingly the universality and obstinacy of that scepticism which discredits every thing that it cannot understand, than the circumstance that his work should have produced so little effect, and that the numerous falls of meteoric stones should have so long been ranked among the inventions of ignorant credulity. Mr. Howard's admirable dissertation was published in the Phil. Trans. for 1802. It is reprinted in the thirteenth volume of Tilloch's Magazine, and ought to be studied as a pattern of scientific research.'

The following table is from the thirty-first vol. of the Ann. de Chimie:—

Chronological List of Meteoric Stones.

Sect. I.—*Before the Christian Era.*

Division 1.—Containing those which can be referred pretty nearly to a date.

A. C.

1478. The thunderstone in Crete, mentioned by Malchus, and regarded probably as the symbol of Cybele.—*Chronicle of Paros*, l. 18, 19.

1451. The shower of stones which destroyed the enemies of Joshua at Bethoron, was probably hail.—*Joshua*, chap. x. 11.

1200. Stones preserved at Orchomenos.—*Pausanias.*

1168. A mass of iron upon Mount Ida, in Crete.—*Chronicle of Paros*, l. 22.

705 or 704. The ancyle, or sacred shield, which fell in the reign of Numa. It had nearly the same shape as those which fell at the Cape and at Agram.—*Plutarch, in Num.*

654. Stones which fell upon Mount Alba in the reign of Tullus Hostilius. 'Crebri cecidere cœlo lapides.'—*Liv.* l. 30.

644. Five stones which fell in China, in the country of Song.—*De Guignes.*

465. A large stone at Ægospotamos, which Anaxagoras supposed to come from the sun. It was as large as a cart, and of a burnt color. 'Qui lapis etiam nunc ostenditur, magnitudine vehis, colore adusto.'—*Plutarch, Pliny,* lib. ii. cap. 58.

465. A stone near Thebes.—*Scholiast of Pindar.*

211. Stones fell in China along with a falling star.—*De Guignes,* &c.

205 or 206. Fiery stones.—*Plutarch, Fab. Max.* cap. 2.

192. Stone fell in China.—*De Guignes.*

176. A stone fell in the Lake of Mars. 'Lapidem in Agro Crustumino in Lacum Martis de cœlo cecidisse.'—*Liv.* xli. 3.

90 or 89. 'Eodem causam dicente, lateribus coctis pluisse, in ejus anni acta relatum est.' —*Plin. Nat. Hist.* lib. ii. cap. 56.

89. Two large stones fell at Yong in China. The sound was heard over forty leagues.—*De Guignes.*

56 or 52. Spongy iron fell in Lucania.—*Plin.*

46. Stones fell at Acilla.—*Cæsar.*

38. Six stones fell in Leang in China.—*De Guignes.*

29. Four stones fell at Po in China.—*De Guignes.*

22. Eight stones fell from heaven, in China.—*De Guignes.*

12. A stone fell at Ton-Kouan.—*De Guignes.*

9. Two stones fell in China.—*De Guignes.*

6. Sixteen stones fell in Ning-Tcheon, and other two in the same year.—*De Guignes.*

Division 2.—Containing those of which the date cannot be determined.

The mother of the gods, which fell at Pessinus.

The stone preserved at Abydos.—*Plin.*

The stone preserved at Cassandria.—*Plin.*

The black stone, and also another preserved in the Caaba of Mecca.

The 'thunderbolt, black in appearance like a hard rock, brilliant and sparkling,' of which the blacksmith forged the sword of Antar.—See *Quarterly Review,* vol. xxi. p. 225, and *Antar,* translated by T. Hamilton, Esq., page 152.

The stone preserved in the coronation chair of the kings of England was not meteoric.

Sect. II.—*After the Christian Era.*

P. C.

In the years 2, 106, 154, 310, and 333, stones fell in China.—*Abel Remusot. Journ. de Physique,* May 1819.

A stone in the country of the Vocontini.—*Plin.*

452. Three large stones fell in Thrace.—*Cedrenus* and *Marcellini, Chronicon.* p. 29. 'Hoc tempore,' says Marcellinus, 'tres magni lapides e cœlo in Thracia ceciderunt.'

Sixth century. Stones fell upon Mount Lebanon, and near Emisa in Syria.—*Damascius.*

About 570. Stones near Bender in Arabia.—*Alkoran,* viii. 16, and cv. 3 and 4.

648. A fiery stone at Constantinople.—*Several Chronicles.*

823. A shower of pebbles in Saxony.

839. Stones fell in Japan.—*Abel Remusat.*

852. A stone fell in Tabaristan, in July or August.—*De Sacy* and *Quatremere.*

856. In December, five stones fell in Egypt.—*The same.*

885. Stones fell in Japan.—*Abel Remusat.*

897. A stone fell at Ahmedabad.—*Quatremere.* In 892, according to the *Chron. Syr.*

921. Great stones fell at Narni. *Benedictus de Saint-Andrea,* in the library of prince Chigi at Rome.

951. A stone fell near Augsburg.—*Alb. Stad.* and others.

998. Two stones fell, one near the Elbe, and the other in the town of Magdeburg.—*Cosmas* and *Spangenberg.*

1009. A mass of iron fell in Djordjan.—*Avicenna.*

1021. Stones fell in Africa between the 24th of July and the 21st of August.—*De Sacy.*

1112. Stones or iron fell near Aquileja.—*Valvasor.*

1135 or 1136. A stone fell at Oldisleben in Thuringia.—*Spangenberg,* and others.

1164. During pentecost, iron fell in Misnia. —*Fabricius.*

1249. Stones fell at Quedlinbourg, Ballenstadt, and Blackenburg, on the 26th July.—*Spangenberg* and *Rivander.*

Thirteenth century. A stone fell at Wurzburg. —*Schottus, Phys. Cur.*

Between 1251 and 1363. Stones fell at Welikoi-Ustiug in Russia.—*Gilbert's Ann.,* tom. 35.

1280. A stone fell at Alexandria in Egypt.—*De Sacy.*

1300 nearly. Great stones fell in Arragon.—*Manuscript Chronicle* in the national museum of Pest in Hungary.

1304, October 1. Stones fell at Friedland or Friedberg.—*Kranz* and *Spangenberg.*

1305. Stones fell in the country of the Vandals.

1328. January 9. In Mortahiah and Dakhaliah. —*Quatremere.*

1368. A mass of iron in the Duchy of Oldenburg.—*Siebrand, Meyer.*

1379, May 26. Stones fell at Minden in Hanover.—*Lerbecius.*

1421. A stone fell in the island of Java.—*Sir T. S. Raffles.*

1438. A shower of spongy stones at Roa, near Burgos in Spain.—*Proust.*

—— A stone fell near Lucerne.—*Cysat.*

1474. Two great stones fell near Viterbo.—*Bibliotheca Italiana,* September, 1820.

1491, March 22. A stone fell near Crema—*Simoneta.*

1492, November 7. A stone of 260 lbs. fell at Ensisheim near Sturgau, in Alsace. It is now in the library of Colmar, and has been reduced to 150 lbs.—Trithemius, *Hirsaug. Annal. Conrad Gesner, Liber. de Rerum Fossilium, Figuris,* cap. iii. p. 66. in his *Opera Zurich,* 1565

1496, January 26 or 28. Three stones fell between Cesena and Bertonori.—*Buriel* and *Sabellicus*.

1511, September 4. Several stones, some of which weighed 11 lbs. and others 8 lbs., fell at Crema.—*Giovanni del Prato*, and others.

1520, May. Stones fell in Aragon.—*Diego de Sayas*.

1540, April 28. A stone fell in the Limousin.—*Bonav. de Saint Amable?*

Between 1540 and 1550. A mass of iron fell in the forest of Naunhoff.—*Chronicle of the Mines of Misnia*.

—— Iron fell in Piedmont.—*Mercati* and *Scaliger*.

1548, November 6. A black mass fell at Mansfeld in Thuringia.—*Bonav. de Saint Amable*.

1552, May 19. Stones fell in Thuringia near Schlossingen.—*Spangenberg*.

1559. Two large stones, as large as a man's head, fell at Miscolz in Hungary, which are said to be preserved in the treasury at Vienna.—*Sthuanfi*.

1561, May 17. A stone called the arx Julia fell at Torgau and Eilenborg.—*Gesner* and *De Boot*.

1580, May 27. Stones fell near Gottingen.—*Bange*.

1581, July 26. A stone, 39 lbs. weight, fell in Thuringia. It was so hot that no person could touch it.—*Binhard, Olearius*.

1583, January 9. Stones fell at Castrovillari.—*Casto, Mercati*, and *Imperati*.

—— March 2. A stone fell in Piedmont of the size of a grenade

1591, June 19. Some large stones fell at Kunnersdorf.—*Lucas*.

1596, March 1. Stones fell at Crevalcore.—*Mittarelli*.

In the sixteenth century, not in 1603. A stone fell in the kingdom of Valencia.—*Cassius* and the *Jesuits of Coimbra*.

1618, August. A great fall of stones took place in Styria.—*Hammer*.

—— A metallic mass fell in Bohemia.—*Kronland*.

1621, April 17. A mass of iron fell about 100 miles south-east of Lahore.—*Jehan Gui 's Memoirs*.

1622, January 10. A stone fell in Devonshire.—*Rumph*.

1628, April 9. Stones fell near Hatford in Berkshire; one of them weighed 24 lbs.—*Gent. Mag*. December 1796.

1634, October 27. Stones fell in Charollois.—*Morinus*.

1635, June 21. A stone fell at Vago in Italy?

—— July 7, or September 29. A stone weighing about 11 oz. fell at Calce.—*Valisnieri*, Opere, vi. 64?

1636, March 6. A burnt-looking stone fell between Sagan and Dubrow in Silesia.—*Lucas* and *Cluverius*.

1637, November 29. Gassendi says, a stone of a black metallic color fell on Mount Vaision, between Guillaume and Perne in Provence. It weighed 54 lbs. and had the size and shape of the human head. Its specific gravity was 3·5. *Gassendi, Opera*, p. 96. Lyons 1658.

1642, August 4. A stone weighing 4 lbs. fell between Woodbridge and Aldborough in Suffolk.—*Gent. Mag*. December 1796.

1643, or 1644.—Stones fell in the sea.—*Wurfbain*.

1647, February 18. A stone fell near Zwicau.—*Schmid*.

—— August. Stones fell in the bailliage of Stolzenem in Westphalia.—*Gilbert's Annal*.

Between 1647 and 1654. A mass fell in the sea—*Willman*.

1650, August 6. A stone fell at Dordrecht.—*Senguerd*.

1654, March 30. Stones fell in the island of Funen.—*Bartholinus*.

A large stone fell at Warsaw.—*Petr. Borellus*.

A small stone fell at Milan, and killed a Franciscan.—*Museum Septalianum*.

1668, June 19 or 21. Two stones, one 300 lbs. and the other 200 lbs. weight, fell near Verona.—Legallois, *Conversations*, &c., Paris 1672. Valisnieri, *Opere*, ii. p. 64, 66. *Montanon* and *Francisco Carli*, who published a letter containing several curious notices respecting the fall of stones from the heavens.

1671, February 27. Stones fell in Suabia.—*Gilbert's Annal*. tom. xxxiii.

1674, October 6. Two large stones fell near Glaris.—*Scheuchzer*.

Between 1675 and 1677, a stone fell into a fishing-boat near Copinshaw.—*Wallace's Account of Orkney*, and *Gent. Mag*. July 1806.

1677, May 28. Several stones, which probably contained copper, fell at Ermundorf near Roosenhaven.—Misc. *Nat. Cur*. 1677. App.

1680, May 18. Stones fell at London.—*King*.

1697, January 13. Stones fell at Pentolina near Sienna.—*Soldani* after *Gabrieli*.

1698, May 19. A stone fell at Waltring.—*Scheuchzer*.

1706, June 7. A stone of 72 lbs. fell at Larissa in Macedonia. It smelt of sulphur, and was like the scum of iron.—*Paul Lucas*.

1715, April 11. Stones fell not far from Stargard in Pomerania.—*Ann. de Gilbert*, lxxi. p. 215.

1722, June 5. Stones fell near Sheflar in Freisingen.—*Meichelbeck*.

1723, June 22. About thirty-three stones, black and metallic, fell near Plescowitz in Bohemia.—*Rost* and *Stepling*.

1727, July 22. Stones fell at Liboschitz in Bohemia.—*Stepling*.

1738, August 18. Stones fell near Carpentras.—*Castillon*.

1740, October 25. Stones fell at Rasgrad.—*Gilbert's Annal*, tom. i.

—— to 1741. A large stone fell in winter in Greenland.—*Egede*.

1743. Stones fell at Liboschitz in Bohemia.—*Stepling?*

1750, October 1. A large stone fell at Niort near Coutance.—*Huard* and *Lalande*.

1751, May 26. Two masses of iron of 71 lbs. and 16 lbs. fell in the district of Agram, the capital of Croatia. The largest of these is now in Vienna.

1753, July 3. Four stones, one of which weighed 13 lbs. fell at Strkow near Tabor.—

Stepling, De Pluvia Lapidea, anno 1753, ad Strkow, et ejus causis, meditatio, p. 4.—*Prag.* 1754.

1750, September. Two stones, one of 20 lbs. and the other of 11 lbs., fell near the villages of Laponas and Pin in Berne.—*Lalande* and *Richard.*

1752, July. A stone fell in Calabria, at Terranuova, which weighed 7 lbs. 7½ oz.—*Domin. Tata.*

1766, end of July. A stone fell at Alboreto in Modena.—*Troil.*

—— August 15. A stone fell at Novellara.—*Troili*?

1768, September 13. A stone fell near Luce in Maine. It was analysed by Lavoisier, &c.—*Mem. Acad. Par.*

—— A stone fell at Aire.—*Mem Acad. Par.*

—— November 20. A stone weighing 38 lbs. fell at Mauerkirchen in Bavaria.—*Imhof.*

1773, November 17. A stone weighing 9 lbs. 1 oz. fell at Sena in Arragon.—*Proust.*

1775, September 19. Stones fell near Rodach in Cobourg.—*Gilbert's Annal.* tom. xxiii.

—— or 1776. Stones fell at Obruteza in Volhynia.—*Gilbert's Annal.* tom. xxxi.

1776 or 1777, January or February, Stones fell near Fabriano.—*Soldani* and *Amoretti.*

1779. Two stones weighing 3½ oz. each, fell at Pettiswoode in Ireland.—*Bingley, in Gent. Mag.* September 1796.

1780, April 1. Stones fell near Beeston in England.—*Evening Post.*

About 1780. Masses of iron fell in the territory of Kinsdale, between West-River Mountain and Connecticut.—*Quarterly Review*, No. 59, April, 1824.

1782. A stone fell near Turin.—*Tata* and *Amoretti.*

1785, February 19. Stones fell at Eichstadt. *Pickel* and *Stus.*

1787, October 1. Stones fell in the province of Charkow in Russia.—*Gilbert's Annal.* tom. xxxi.

1790, July 24. A great shower of stones fell at Barbotan near Roquefort, in the vicinity of Bourdeaux. A mass fifteen inches in diameter penetrated a hut, and killed a herdsman and a bullock. Some of the stones weighed 25 lbs. and others 30 lbs.—*Lomet.*

1791, May 17. Stones fell at Cassel-Beradenga, in Tuscany.—*Soldani.*

—— October 20. Stones fell at Menabilly, in Cornwallis.—*King.*

1794, June 16. Twelve stones, one of which weighed 7½ oz., fell at Sienna. Howard and Klaproth have analysed these stones.—*Philosophical Transactions*, 1794, p. 103.

1795, April 13. Stones fell at Ceylon.—*Beck.*

—— December 13. A large stone weighing 55 lbs. fell near Wold Cottage in Yorkshire. No light accompanied the fall.—*Gent. Mag.* 1796.

1796, January 4. Stones fell near Belaja-Zerkwa in Russia.—*Gilbert's Annal.* tom. xxxv.

—— February 19. A stone of 10 lbs. fell in Portugal.—*Southey's Letters from Spain.*

1798, March 8 or 12. Stones, one of which was the size of a calf's head, fell at Sales.—*Marquis de Drée.*

—— December 19. Stones fell in Bengal—*Howard, Lord Valentia.*

1801. Stones fell on the island of Tonneliers.—*Bory de St. Vincent.*

1802, September. Stones fell in Scotland?—*Monthly Magazine*, October 1802.

1803, April 26. A great fall of stones took place at Aigle. They were about 3000 in number, and the largest weighed about 17 lbs.

—— July 4. Stones fell at East Norton.—*Phil. Mag.* and *Bibl. Brit.*

—— October 8. A stone fell near Apt.

—— December 13. A stone fell near Eggenfielde in Bavaria weighing 3½ lbs.—*Imhof.*

1804, April 5. A stone fell at Possil, near Glasgow.—*Phil. Mag.*

——— 1807. A stone fell at Dordrecht.—*Van Beck Calkoen.*

1805, March 25. Stones fell at Doroninsk in Siberia.—*Gilbert's Annal.* tom. xxix. and xxxi.

—— June. Stones covered with a black crust fell in Constantinople.—*Kengas Ingigian.*

1806, March 15. Two stones fell at St. Etienne and Valence; one of them weighed 8 lbs.

—— May 17. A stone weighing 2½ lbs. fell near Basingstoke in Hampshire.—*Monthly Magazine.*

1807, March 13 (June 17 according to Lucas). A stone of 160 lbs. fell at Timochin, in the province of Smolensko in Russia.—*Gilbert's Annal.*

—— December 14. A great shower of stones fell near Weston in Connecticut. Masses of 20 lbs. 25 lbs. and 35 lbs. were found.—*Silliman and Kingsley.*

1808, April 19. Stones fell at Borgo San Donino.—*Guidotti* and *Sgagnoni.*

—— May 22. Stones weighing 4 lbs. or 5 lbs. fell near Stannern in Moravia.—*Bibl. Brit.*

—— September 3. Stones fell at Lissa in Bohemia.—*De Schreibers.*

1809, June 17. A stone of 6 oz. fell on board an American vessel, in lat. 30° 58′ N., and long. 70° 25′ W.—*Bibl. Brit.*?

1810, January 30. Stones, some of which weighed about 2 lbs, fell in Caswell county, North America.—*Phil. Mag.* vol. xxxvi.

—— July. A great stone fell at Shahabad in India. It burned five villages, and killed several men and women.—*Phil. Mag.* xxxvii. p. 236.

—— August 10. A stone weighing 7¾ lbs. fell in the county of Tipperary in Ireland.—*Phil. Mag.* vol. xxxviii. Mr. W. Higgins published an analysis of it.

—— November 23. Stones fell at Mortelle, Villerai, and Moulinbrulé, in the department of the Loiret; one of them weighed 40 lbs. and the other 20 lbs.—*Nich. Journal*, vol. xxxix. p. 158.

1811, March 12 or 13. A stone of 15 lbs. fell in the province of Poltawa in Russia.—*Gilbert's Annals*, xxxviii.

—— July 8. Stones, one of which weighed 3½ oz., fell near Berlanguillas in Spain.—*Bibl. Brit.* tom. xlviii. p. 162.

1812, April 10. A shower of stones fell near Thoulouse.

—— April 15. A stone, the size of a child's head, fell at Erxleben. A specimen of it is in the possession of Professor Haussman of Brunswick. *Gilbert's Annal.* xl. and xli.

—— August 5. Stones fell at Chantonay.—*Brochant.*

1813, March 14. Stones fell at Cutro in Calabria, during a great fall of red dust.—*Bibl. Brit.* October 1813.

—— September 10. Several stones, one of which weighed 17 lbs., fell at Limerick in Ireland.—*Phil. Mag.*

1814, February 3. A stone fell at Bacharut in Russia.—*Gilbert's Annal.* tom. i.

—— September 5. Stones, some of which weighed 8 lbs., fell in the vicinity of Agen.—*Phil. Mag.* vol. xlv.

—— November 5. Stones, of which nineteen were found, fell in the Doab in India.—*Phil. Mag.*

1815, February 18. A stone fell at Duralla in India.—*Phil. Mag. Journal of Science.*

—— October 3. A large stone fell at Chassigny, near Langres.—*Pistollet. Ann. de Chim.*

1816. A stone fell at Glastonbury in Somersetshire.—*Phil. Mag.*

1817, May 2 and 3. There is reason to think that masses of stone fell in the Baltic after the great meteor of Gottenburg.—*Chladni?*

1818, February 15. A great stone appears to have fallen at Limoge, but it has not been disinterred.—*Gazette de France*, Feb. 25, 1818.

—— March 30. A stone fell near Zuborzyca in Volhynia (analysed by *M. Laugier, Ann. de Museum*, 17th year, 2d number).

—— July 29. O. S. A stone of 7 lbs. fell at the village of Slobodka in Smolensko. It penetrated nearly sixteen inches into the ground. It had a brown crust with metallic spots.

1819, June 13. Stones fell at Jonzac, department of the lower Charente. These stones contain no nickel.

—— October 13. Stones fell near Politz, not far from Gera or Kostritz, in the principality of Reuss.—*Gilbert's Annals*, lxiii.

1820, 21st to 22d March. A stone fell in the night at Vedenburg in Hungary.—*Hesperus*, xxvii. *cah.* 3.

—— July 12. A stone fell near Likna, in the circle of Dunaborg, province of Witepsk in Russia.—*Th. Grotthus. Ann. de Gilbert*, lxviii.

1821, June 15. Stones fell near Juvenas, containing no nickel.

1822, June 3. A stone fell at Angers.—*Ann. de Chim.*

—— September 10. A stone fell near Carlstadt in Sweden.

—— September 13. A stone fell near La Baffe, canton of Epinal, department of Vosges.—*Ann. de Chim.*

1823, August 7. A stone fell near Nobleboro in America.—*Silliman's American Journal*, vii.

1824, towards the end of January. Many stones fell near Arenazzo, in the territory of Bologna. One of them, weighing 12 lbs., is preserved in the Observatory of Bologna.—*Diario di Roma.*

—— beginning of February. A great stone fell in the province of Irkutsk in Siberia.—*Some journals.*

—— October 14. A stone fell near Zebrak, circle of Beraum, in Bohemia. The stone is preserved in the national museum of Prague.

List of Masses of Iron supposed to have fallen from the Heavens.

Sect. I.—*Spongy or Cellular Masses containing Nickel.*

1. The mass found by Pallas in Siberia, to which the Tartars ascribe a meteoric origin. —*Voyages de Pallas*, tom. iv. p. 545. *Paris*, 1793.
2. A fragment found between Eibenstock and Johanngeorgenstadt.
3. A fragment probably from Norway, and in the imperial cabinet of Vienna.
4. A small mass weighing some pounds, and now at Gotha.
5. Two masses in Greenland, out of which the knives of the Esquimaux were made.—See Ross's *Account of an Expedition to the Arctic Regions.*

Sect. II.—*Solid Masses where the Iron exists in Rhomboids or Octohedrons, composed of Strata, and containing Nickel.*

1. The only fall of iron of this kind is that which took place at Agram in 1751.
2. A mass of the same kind has been found on the right bank of the Senegal.—*Compagnon, Forster, Goldberry.*
3. At the Cape of Good Hope; Stromeyer has lately detected cobalt in this mass.—*Van Marum* and *Dankelman; Brande's Journal*, vol. vi. 162.
4. In different parts of Mexico.—*Sonneschmidt, Humboldt*, and the *Gazette de Mexico*, tom. i. and v.
5. In the province of Bahia in Brasil. It is seven feet long, four feet wide, and two feet thick, and its weight about 14,000 lbs.—*Mornay* and *Wollaston; Phil. Trans.* 1816, p. 270, 281.
6. In the jurisdiction of San Jago del Estera.—*Rubin de Cælis*, in the *Phil. Trans.* 1788, vol. lxxviii. p. 37.
7. At Elbogen in Bohemia.—*Gilbert's Annal.* xlii. and xliv.
8. Near Lenarto in Hungary.—*Ditto*, xlix.

The origin of the following masses seems to be uncertain, as they do not contain nickel, and have a different texture from the preceding :—

1. A mass found near the Red River, and sent from New Orleans to New York.—*Journ. des Mines*, 1812, *Bruce's Journ.*
2. A mass at Aix-la-Chapelle containing arsenic. —*Gilbert's Annal.* xlviii.
3. A mass found on the hill of Brianza in the Milanese.—*Chladni* in *Gilbert's Annal.* l. p. 275.

We must not omit to add, that Dr. Brewster has furnished a very beautiful theory of the formation of meteoric stones.

METHEG'LIN, *n. s.* Welsh *meddyglin.* A word like the first syllable is found in both the eastern and northern languages for a sweet drink, see MEAD: the termination *glyn,* as Minsheu says, signifies glutinosum, glutinous. A species of fermented honey-drink.

White-handed mistress, one sweet word with thee.
—Honey and milk, and sugar; there is three.
Nay then two treys; and, if you grow so nice,
Metheglin, wort, and malmsey. *Shakspeare.*

To' allay the strength and hardness of the wine,
And with old Bacchus new *metheglin* join. *Dryden.*

METHEGLIN is a species of mead; one of the most pleasant and general drinks the northern parts of Europe afford, and much used among the ancient inhabitants. There are various methods of making it; one of the best is the following:—Put as much new honey, naturally running from the comb, into spring water as that when the honey is thoroughly dissolved an egg will not sink to the bottom, but be just suspended in it; boil this liquor for an hour or more, till the egg swim well above the liquor; when very cool, next morning, it may be barrelled up, adding to each fifteen gallons an ounce of ginger, as much of mace and cloves, and half as much cinnamon, all grossly pounded; a spoonful of yeast may also be added at the bung-hole to promote the fermentation. When it has done working it may be closely stopped up; and after it has stood a month it should be drawn off into bottles.

METHINKS', *imp. v.* } Me and thinks. A
METH'OUGHT, *pret.* } Norman corruption, confounding me and I, as Dr. Johnson observes; meseems, as he suggests, would be more grammatical: it appears to me; I think.

In all ages poets have been had in special reputation, and, *methinks,* not without great cause; for, besides their sweet inventions, and most witty lays, they have always used to set forth the praises of the good and virtuous. *Spenser on Ireland.*

Methought a serpent eat my heart away,
And you sat smiling at his cruel prey. *Shakspeare.*

Methought I saw him placable, and mild,
Bending his ear: persuasion in me grew
That I was heard with favour; peace returned
Home to my breast; and to my memory
His promise, 'That thy seed shall bruise our foe.' *Milton.*

If he choose out some expression which does not vitiate the sense, I suppose he may stretch his chain to such a latitude; but by innovation of thoughts, *methinks,* he breaks it. *Dryden.*

Methought I stood on a wide river's bank,
Which I must needs o'erpass, but knew not how. *Id.*

There is another circumstance, which, *methinks,* gives us a very high idea of the nature of the soul, in regard to what passes in dreams, that innumerable multitude and variety of ideas which then arise in her. *Addison's Spectator.*

Methinks already I your tears survey. *Pope.*

Far happier are the dead, *methinks,* than they
Who look for death and fear it every day. *Cowper.*

METH'OD, *n. s.*
METHOD'ICAL, *adj.*
METHOD'ICALLY, *adv.*
METH'ODISE,
METH'ODIST, *n. s.*
} Fr. *methode;* Lat. *methodus;* Gr. μεθοδὸς, a path or way. Order; arrangement; way; or manner: methodical is, orderly; well arranged: to methodise, to dispose in due order; to regulate: a methodist, hardly known in our language in the general sense, means particularly an ancient sect of physicians, and the large and respectable body of Christians described at length in the following article.

To see wherein the harm which they feel consisteth, the seeds from which it sprang, and the *method* of curing it, belongeth to a skill, the study whereof is full of toil, and the practice beset with difficulties. *Hooker.*

If you will jest with me know my aspect,
And fashion your demeanour to my looks,
Or I will beat this *method* in your sconce. *Shakspeare.*

To begin *methodically,* I should enjoin you travel; for absence doth remove the cause, removing the object. *Suckling.*

Our wariest physicians, not only chemists but *methodists,* give it inwardly in several constitutions and distempers. *Boyle.*

All the rules of painting are *methodically,* concisely, and clearly, delivered in this treatise. *Dryden.*

Resolved his unripe vengeance to defer,
The royal spy retired again unseen,
To brood in secret on his gathered spleen,
And *methodise* revenge. *Id. Boccace.*

It will be in vain to talk to you concerning the *method* I think best to be observed in schools, *Locke on Education.*

Notwithstanding a faculty be born with us, there are several *methods* for cultivating and improving it, and without which it will be very uncertain. *Addison's Spectator.*

The man who does not know how to *methodise* his thoughts has always a barren superfluity of words; the fruit is lost amidst the exuberance of leaves. *Id.*

He can take a body to pieces, and dispose of them where he pleases; to us, perhaps, not without the appearance of irretrievable confusion; but, with respect to his own knowledge, into the most regular and *methodical* repositories. *Rogers.*

Those rules of old discovered, not devised,
Are nature still, but nature *methodised.* *Pope.*

Method, taken in the largest sense, implies the placing of several things, or performing several operations, in such an order as is most convenient to attain some end. *Watts.*

O! what a fund of genius, pent
In narrow space, is here!
This volume's *method* and intent,
How luminous and clear. *Cowper.*

'The Trial of the Spirits,'—would make an admirable tract on the subject. But the inconvenience is that the *Methodists* would say your Lordship had written against them; an honour which, for their own sakes, one would not wish them. *Hurd's Letters to Warburton.*

METHODISTS, METHODICI, in the history of medicine, a sect of ancient physicians, who reduced the whole art of healing to a few common principles or appearances. The Methodists were the followers of Thessalus; whence they were also called Thessalici. They were strenuously opposed by Galen in several of his writings; who scrupled not to assert that the Methodical heresy ruined every thing that was good in the art. Quincy erroneously uses Methodists (Methodici) for those physicians who adhered to the doctrine of Galen and the schools, in opposition

to empirics and chemists, who used violent medicines and pretended secrets or nostrums.

METHODISTS, in ecclesiastical history, a denomination applied to different sects, both of Papists and Protestants.

METHODISTS, POPISH, were those polemical doctors of whom the most eminent arose in France, towards the middle of the seventeenth century, in opposition to the Huguenots or Protestants. These Methodists, from their different manner of treating the controversy with their opponents, may be divided into two classes. The one comprehends those doctors whose method of disputing with the Protestants was disingenuous and unreasonable, and who followed the examples of those military chiefs who shut up their troops in intrenchments and strong holds, in order to cover them from the attacks of the enemy. Of this number were the Jesuit Veron, who required the Protestants to prove the tenets of their church by plain passages of Scripture, without being allowed the liberty of illustrating those passages, reasoning upon them, or drawing any conclusions from them; Nihusius, formerly a Protestant; the two Walenburghs, and others, who confined themselves to the business of answering objections and repelling attacks; and cardinal Richelieu, who confined the whole controversy to the single article of the divine institution and authority of the church. The Methodists of the second class were of opinion that the most expedient manner of reducing the Protestants to silence was, not to attack them by piecemeal, but to overwhelm them at once by the weight of some general principle or presumption, some universal argument, which comprehended or might be applied to all the points contested between the two churches; thus imitating the conduct of those military leaders who, instead of spending their time and strength in sieges and skirmishes, endeavoured to put an end to the war by a general and decisive action. These polemics rested the defence of Popery upon prescription, the wicked lives of Protestant princes who had left the church of Rome, the crime of religious schism, the variety of opinions among Protestants with regard to doctrine and discipline, and the uniformity of the tenets and worship of the church of Rome. To this class belong Nicolle the Jansenist doctor, the famous Bossuet, &c.

METHODISTS.

METHODISTS. The rise and spread of the modern Methodists, viewed in connexion with the character of their founder and his principal associates, and the circumstances of their commencement and extension, present numerous subjects for interesting contemplation to the statesman, the philosopher, and the divine. On the peculiarities of Methodism the most opposite opinions have been formed, and these varying opinions have been expressed in almost all the forms and degrees of panegyric and vituperation. If, however, there be taken into account the widely extending influence of Methodism in both hemispheres, its strenuous and incessant activity, and the efficacy of its strong and plastic organisation, it will appear reasonable that persons should qualify themselves to form a correct opinion on the subject by calm, candid, and extended enquiry. Doubtless there must be something remarkable in a system which has been characterised in the strongest terms of admiration or censure by so many eminent observers, including persons possessing all grades of talent and opinion, between the extremes of bishops Lavington and Warburton on the one hand and Dr. Priestley on the other, and downwards again from the philosophising apostle of Unitarianism to the poetical biographer of Mr. Wesley—Dr. Southey. That which has extorted reluctant praise from many distinguished writers, who commenced their researches with no prepossessions in its favor, cannot be credibly represented as totally worthless and mischievous; and, on the other hand, while the violence with which it has been assailed and stigmatised may justly excite grave doubts respecting the competent information and candor of the impugners, their numbers and their confidence place the methodist system in a defensive position, as being under some presumptions of blame.

To develope this subject as copiously as the variety and importance of its topics deserve is incompatible with the brevity imposed by the nature of our work. Our aim therefore, in this article, will be not so much to express or enforce any opinions of our own as to furnish our readers with the means of forming their own judgment on the general character and influence of Methodism, in connexion with the chief particulars of its history.

As a term of modern use the name of Methodists appears to have been first brought forward in the days of Puritanism; being suggested by the Latin appellative, Methodistæ, which was given to a college of physicians in ancient Rome, in consequence of the strict regimen under which they placed their patients, it was of ready application to the puritans or precisians in religion, as they were then sometimes called, which is indeed a term of much the same import with that of Methodists. Appellations of this description, which convey the idea of dislike and reproach, are not likely to be soon forgotten, and stand always ready for revival under similar circumstances to those which gave them birth. When it came to pass therefore, about the year 1730, that Mr. John Wesley, then fellow of Lincoln College Oxford, had prevailed upon other members of the University, principally his own pupils, to join with himself in stricter religious observances than were at that period fashionable in Oxford, adversaries and satirists of these proceedings soon appeared, who were not slack in reviving the puritan appellation, and fixing it upon Mr. Wesley and his companions. A few years after this Messrs. John and Charles Wes-

ley and Mr. Whitefield commenced their novel career in the religious world. Partly because they were excluded from the churches for the supposed singularity and enthusiasm of their opinions, and partly because they were carried forward by the zealous feelings which those opinions did actually inspire, they began to preach in the open air, and to organise distinct religious societies. Such proceedings would of course excite public attention; and it was perfectly natural that their former college contemporaries, hearing of these things, should revive their old satirical appellative, and give it general currency and circulation.

It was also to be expected, as was actually the case, that this name should at first embrace all persons who, with whatever varying views and principles, exhibited more than ordinary concern on the subject of religion; and this comprehensive meaning is indeed, as yet, far from being exploded. Viewing it more strictly, however, as a distinct denomination of professing Christians, it includes the two great branches of Calvinistic, and Arminian or Wesleyan Methodists. The former, it is true, are to a considerable extent identified with the regular Independent dissenters. From these, however, the Calvinistic Methodists may be distinguished by some strongly marked features of difference.

1. As a body they adhere to the system of Calvinist doctrine in all its technical accuracy of statement, with less of modern and mitigating explanation than is customary among Independents in general.

2. They have chapels in London, Bristol, and other places, which owe their erection to the pious liberality of Selina, countess of Huntingdon, and the influence of Mr. Whitefield; and the appointment of ministers in these chapels is vested in trustees nominated under the regulations of the above named excellent persons, and not in members of the religious societies assembling in those chapels, according to the fundamental principles of Independency. The Calvinistic Methodists also vary from this model in another respect, being understood to be united under a federative constitution, though much looser in its provisions than that of Wesleyan Methodism.

3. The church of England in its general institutions, and especially in its liturgical services, is much more favorably considered by both the great branches of the Methodists than by the regular dissenters. Hence it frequently occurs that the forms of the church are employed amongst the Methodists in their public worship.

The specific ground, indeed, of what may perhaps be more properly called variation from the order of the establishment than formal dissent from it, amongst Methodists of all descriptions, is the desire of possessing greater advantages for the enjoyment of what they conceive to be spiritual religion than can be realised by a course of strict conformity. Their objections to the church of England incline to the side of administration, rather than of constitution; thus great numbers of Methodists resident in the country villages attend more or less punctually upon the services of the church, and bring up their families within its pale.

The way is now cleared for treating particularly of the Wesleyan Methodists, who constitute perhaps the greatest portion of the whole body of Methodists, who embrace the doctrines promulgated by the Rev. John Wesley and conduct their ecclesiastical affairs on the plan of organisation which he was led step by step to adopt, during a long course of successive years.

The various parts of this remarkable organisation Mr. Wesley was led to adopt, as occurring circumstances called for them, and a strong conviction of duty, overpowering his attachment to established order, seemed imperatively to require. From the doctrines of the church of England, as Dr. Southey well observes, he never knowingly or willingly departed, being conscientiously satisfied with them after free and full enquiry. In the interpretation of these doctrines, Mr. Wesley adopts the principles of Arminius, stated, however, in a remarkably guarded and moderate way. The doctrinal works which form the legally established standard of the body, are the first four volumes of his sermons and his notes on the New Testament. On the subject of the Trinity, and all the points of doctrine it involves, the sentiments of the Wesleyan Methodists coincide in terms with the first four general councils and the creeds and articles of the church derived from them. The doctrine likewise of the total depravity of human nature is generally held by Mr. Wesley's followers as expressed in the ninth article. Here, however, their Arminianism induces a particular explanation, if it be not a radically different modification of opinion. While with the article they hold that original sin is that corruption of nature whereby man is 'very far gone from original righteousness, and is of his own nature inclined to evil;' yet they conceive that although man, in the abstract, so to speak, is thus totally corrupt, yet considering him in the concrete, or in the reality of his actual existence, each individual of our fallen race, through the redemption which is in Christ Jesus, partakes of an ameliorating principle—a ray of vivifying light which shines in the darkness of the natural mind, and is designed to lead him fully from a death in sin to a life of righteousness. On the subject of justification, or the mode of constituting sinful man righteous before God, the only difference of any moment between the Wesleyan Methodists and orthodox Christians in general is this, that they connect with the personal justification of a sinner a certain impression on his mind which they term the witness of the Spirit. This they describe as a direct testimony, borne by the Spirit of God, to the conscience of a penitent believer, that his sins are forgiven and himself now received into the favor of God. While, however, they strenuously assert that the witness of the Spirit thus understood is the common privilege of Christians, without which they ought not to rest satisfied, yet they are far from making it the absolute sine quâ non of a gracious state. And, lest any person should be disposed to rest in the professed experience of this blessing, as superseding the necessity of a moral character formed on the precepts of the gospel, Mr. Wesley endeavours to provide a suitable guard of his doctrine in

the following terms:—'Let none ever presume to rest in any supposed testimony of the Spirit, which is separate from the fruit of it. If the Spirit of God does really testify that we are children of God, the immediate consequence will be the fruit of the Spirit, even love, joy, peace, long-suffering, gentleness, goodness, fidelity, meekness, temperance.' On the great subject of regeneration, also, it would not appear that there is any absolute irreconcilableness between Mr. Wesley's principles and those of other Christian professors. The necessity of a divine influence to create in fallen man a clean heart, and renew a right spirit within him, is common ground; and when the Methodist doctrine of the consummation of this regenerating change by a state which, in the theological nomenclature of the body, is called Christian perfection, is closely and candidly analysed, it may appear more in unison, especially with the views of the Established Church, than is commonly supposed. 'Christian perfection,' says Mr. Wesley, in his later and more matured writings on this subject, 'is a constant communion with God, which fills the heart with humble love. The only perfection of which man is capable, while he dwells in a corruptible body, is the complying with that kind command, My son, give me thine heart. It is the loving the Lord his God with all his heart, and with all his soul, and with all his mind.' On no other doctrines than these now brought forward does there appear to exist among the Methodists any material variation of statement from that usually adopted by what are called orthodox Christians. And it is proper to observe that the general scheme of Wesleyan Methodist doctrine, while substantially Arminian, is, after Mr. Wesley's example, carefully guarded from the extremes of that system, in the theological teaching of the preachers at large. The following expression of their views, as recorded in the Minutes of Conference for 1821, is worthy of particular notice:—'We again solemnly resolve, after the example of our venerable father in the Gospel, to preach a free, present, and full, salvation from sin; a salvation flowing from the mere grace of God, through the redemption which is in Christ Jesus, apprehended by the simple exercise of faith, and indispensably preparatory to a course of practical holiness. And in this great work, our only reliance for success is upon the promised grace of the Spirit, by whose inspiration alone it is, that the Gospel, in any instance, is rendered the power of God unto salvation.'

The progressive steps by which the Wesleyan Methodists became a distinct religious body may be readily anticipated by careful and intelligent observers of human character and history. The societies collected in London, Bristol, and other parts of the island, under the ministry of the Rev. J. and C. Wesley, and other clerical co-adjutors, were divided into little companies of from ten to twenty persons, called *classes*, and given in charge to a discreet person, called a leader. It was his business to preside in a weekly meeting of his class for spiritual conversation and prayer, to receive such contributions as his members were disposed to give to the relief of the poor, and the current expenses of the society, and to pay such monies over weekly to the stewards of the society, who were persons appointed to manage its temporal affairs. Soon after the formation of the society it became needful to build large rooms for general meetings of the whole society, who, thus congregated, were called *body bands*, and also for public worship; and thus it became needful to appoint suitable persons to conduct public service in these rooms by prayer and reading of sermons, or exposition of the Scriptures. These functionaries, as might be expected, soon became regular preachers; and being recognised, although at first with considerable reluctance, by Mr. Wesley, in this new character, they were appointed by him to extend their labors to the villages and hamlets of the circumjacent country. In this manner, then, originated those important territorial divisions, in the economy of Wesleyan Methodism, which are denominated *circuits*. These consist of the societies and congregations in a given tract of country surrounding some considerable place, called the head of the circuit, and where the residence of the preachers is ordinarily fixed. The circuits thus constituted are placed under the direction of one, two, or more, preachers, rarely exceeding five, according to their magnitude and importance, one of whom, generally the preacher of longest standing in the body, is entrusted with the general direction of the affairs of his circuit. His name of office was formerly the assistant, but now he is called the superintendant. The former of these names is important, as connected with the government of the Methodist body, during the life of Mr. Wesley, under whose personal administration it was actually placed. This system of government he carried on in a constant round of itinerancy, which brought him, at regular periods, through all those parts of the British islands in which Methodist societies were established. Thus he exercised a personal supervision over the whole connexion, as the great body united under himself was very appropriately designated. But, in Mr. Wesley's absence, the preacher selected by himself, and on that ground called the assistant, governed the societies in his circuit: it being understood, however, that, on all points of the exercise of his delegated authority, an appeal lay to Mr. Wesley in the *conference*. This body occupies a very important position in the Methodist connexion, and it will be needful briefly to trace the steps by which it has attained to it. The first conference, formally so called, was held in the year 1744, and was, in fact, nothing more than a company of persons choosing to carry on, in a methodical form, by way of question and answer, a discussion on Christian doctrines and principles, involving some leading peculiarities of Methodism. The persons meeting with Mr. Wesley at this first conference were clergymen. But it soon came to pass that the lay preachers, as they then were called, with the addition of two or three clergymen closely associated with Mr. Wesley, composed the conference; that the entire government and discipline of the Methodist body were treated of in that assembly; and that the discussion of these subjects constituted its regular functions. At these

annual assemblies, therefore, explanations of doctrine were brought forward, the stations of the preachers for the ensuing year were fixed, and the general and widely extending business of the body was transacted. During the life of Mr. Wesley he summoned to the conference such preachers as he pleased; and, while he heard their opinions on all the affairs which might be brought forward, he strictly reserved the ultimate decision to himself. It could not, however, fail to happen, and was, indeed, quite in conformity with Mr. Wesley's intentions, that the conference should by degrees acquire the respect and authority attaching to the ruling body in the Methodist connexion; and that the preachers in that assembly who had taken pains to acquaint themselves with the economy of the connexion, and were most largely endowed with the requisite qualities for managing public deliberations, should acquire a commanding influence over its decisions. This would increasingly be the case, in proportion as Mr. Wesley began to feel the infirmities attendant upon advancing years. His views, with regard to the conference which he had trained up for the management of the connexion, and the full exercise, after his decease, of his own authority, are fully developed in the deed of declaration, executed in 1784. The great object of this instrument was to specify the meaning of the term conference, so that there might be no uncertainty respecting the individuals who might legally officiate in various chapels, or meeting-houses, conveyed to trustees for the purpose of permitting such persons as should be appointed by 'the conference of the people called Methodists' to preach and expound the word of God therein. In this constituent act of the connexion Mr. Wesley also selects 100 of his preachers to constitute the legal conference, points out the method by which that number is to be perpetually kept up, and fixes an itinerancy or continual change of preachers as the unalterable rule of the body. A few years afterwards he departed this life, leaving a letter directed to the preachers who should assemble together in the first conference after his decease, in which he strictly charges the 100 preachers constituting the legal conference to assume on that ground no superiority over their brethren, who, having completed their probationary term of four years, were received as full members of the conference: such reception is technically called 'being admitted into full connexion.' In consequence of this solemn charge from their venerable founder the 100 have reserved to themselves no substantial superiority over their junior brethren, save what is due to age and experience. Of course, the appointment of president and secretary of the conference would properly rest in their own number; in this business, however, they adopt, as co-electors with themselves, all the preachers of fourteen years standing; in whose favor, also, is the provision that one-third of all the vacancies in the 100 shall be filled up by election from amongst them, and which, therefore, deviates thus much from the rule of seniority. In all other points the young men newly received into full connexion have an equal voice with the seniors.

In the years immediately succeeding the death of Mr. Wesley serious agitations arose in the Methodist body, which especially respected, in their first development, its peculiarity of position relative to the church of England. As, on the one hand, it is to be believed that Mr. Wesley was quite sincere in all his professions of attachment to that church; so, on the other, it cannot be successfully denied that the measures he took, towards the close of his life, went to organise and perpetuate another religious society, having in it all the institutions proper to a church of Christ, and differing materially from the Anglican church in ecclesiastical regimen. Such was the deed of declaration, the tendency of which was to legalise and perpetuate Methodism as a distinct religious system, and the ordination to the full ministry of some of the preachers, first in the newly separated states of America, then in Scotland, and finally in England itself. That Mr. Wesley contemplated also the introduction of service amongst his people, in what are called canonical hours, is probable from his abridgment of the Liturgy for their use. For the services contained in this admirable formulary, and indeed the ordinances generally of the establishment, he manifested to the end of his life the highest veneration and attachment. The following hypothesis seems best to reconcile all the facts of the case:—Mr. Wesley's views, in relation to the system of which he was the founder, varied considerably as the system itself was brought into operation upon the great mass of the people; he saw more and more clearly the obstacles which the deeply-rooted feelings of the clergy on the one hand, and of his own people on the other, interposed to the accomplishment of his ardent wishes respecting a close unison with the established church: he therefore reluctantly, but conscientiously, acquiesced in what he was constrained to believe was the will of God; this was that the Methodists should ultimately assume the character of a distinct religious society, fully provided in itself with all things necessary to the structure of a Christian church, and yet subsisting in a form as little opposed to the church of England as was compatible with such an organisation. To this effect when, in A.D. 1788, Mr. Wesley set apart Messrs. A. Mather, Thomas Rankin, and Henry Moore, for the sacred office by imposition of hands and prayer, without sending them out of England; he strongly advised them, that, according to his example, they should continue united to the established church, so far as the blessed work in which they were engaged would permit.—*Myles's Chronological History*.

Such was the posture of things in external and internal relations in which the Methodist connexion found itself at Mr. Wesley's death. On this event the conference entered into that full authority over the whole body, which Mr. Wesley designed should in that case devolve upon them. In order, therefore, to provide fully for the continuance of this ever active and ready supervision of the body, in the exercise of every part of its discipline so far as might be needful during the intervals of its annual sessions, they divided the connexion into *districts*, composed of all the itinerant preachers stated in a given number of

circuits; and by subsequent provisions, so far as financial matters are concerned, the stewards of the circuits are, in district meetings, associated with them. These are officers to whom is entrusted the management of the temporal affairs of the circuits. These districts, now placed under the superintendance of a chairman, have ordinary and extraordinary functions; their ordinary functions consist in preparing various matters of discipline and finance for the final settlement at the conference, and also in the preparatory examination on given subjects of candidates for the itinerant work. When the district is assembled for the discharge of its extraordinary functions it is called a special district meeting; in this capacity it investigates charges against any of the preachers, and, if it sees fit, suspends them from their office until the ensuing conference. It is, moreover, invested with authority to settle all matters of dispute and strife which may arise in any of the circuits within its bounds, and appear sufficiently important to require its intervention, until the next annual meeting of that assembly.

But it was a much more easy task to settle the form of government, than to bring the people to understand the real situation of the Methodist body in respect of the established church, and to acquiesce in the general principles of government and administration which Mr. Wesley had provided for them. A party displayed itself both in the conference and the connexion, strong in numbers, enterprising in effort, and determined in resolution, who sought for the immediate and unconditional establishment of service in church hours, and the administration of the sacrament by their own preachers. They were firmly opposed, however, by another party, including in its ranks much of the real respectability and piety of the body, as existing both amongst preachers and people. These, adhering with unbending tenacity to the old plan, as it was called in the controversies of those days, strongly opposed what they thought to be dangerous innovations; their tenacity on these subjects was, in some points of view, far from discreditable to them, though it manifested a want of comprehensive regard to the spiritual wants of a widely extending population, for whose souls at that time only Methodism, on a large scale, cared, and alone was capable, by the special provisions of Mr. Wesley himself, of making an adequate spiritual provision for them. At the same time the party, wishing for the full developement of Mr. Wesley's plans and principles, seem to have been far from proceeding in their meditated designs for change in that cautious and temperate manner, which respect for his wishes, and even honest prejudices as a minister of the Church of England, ought to have inspired, and which was further needful to the rendering those changes as extensive a blessing to the connexion and the kingdom as their more judicious and enlightened advocates desired. Agitations on this subject prevailed for three or four years; at last, however, the conference made a pretty generally successful effort to reconcile these conflicting views by an act which was called the plan of pacification, which allowed, under certain circumstances, of the wished-for concessions. On this proceeding the Rev. Richard Watson thus very properly remarks in his Observations upon Southey. 'So far from Mr. Wesley's views and principles having lost their influence with the conference, the sacrament was forced upon none, neither was it recommended to be received from Wesleyan ministers, in preference to the clergymen of the Established Church. The old principles were held as fast as higher duties would allow, and the plan itself, adopted at once to meet a case of conscientious scruple, while it avoided encouraging a departure from the primitive mode; and leaving every individual to act as he was persuaded in his own mind, whether to receive the sacrament at church or meeting, has at length been cordially acquiesced in by both parties as equally warranted by principle and by prudence.'

While these disputes were going on in the connexion, and the conference for some years, as many thought very unreasonably and improperly, delayed the gratification of the wishes of a large proportion of the people, the power of that governing body itself came into discussion; and it is no matter of surprise that such should have been the case in those times of general ferment respecting power, liberty, and government, which mark the memorable epoch, and some of the early years of the French revolution. It was stoutly contended that the power of the conference was unscriptural, arbitrary, and dangerous; and, under this impression, that body received addresses from various quarters, to this effect. 'That the people might be represented in the conference by delegates, chosen by, and from amongst themselves; or that in future the conference might be composed of an equal number of preachers and representatives of the people.' This plan was alleged by its promoters to carry on the face of it, equity, harmony, and a pledge of future prosperity. It was not, however, acceded to by the conference; which, nevertheless, sought to meet the wishes of the people, and the real exigencies of the case, by important, and, as they deemed, effectual concessions, guarding against the abuse of the power lodged in it, and providing for the inviolability of rational and Christian liberty in the connexion. These additional regulations, limiting the exercise of power, and strictly defining the modes and circumstances of its exercise, are published in the minutes of the Leeds conference, A.D. 1797. This year was remarkable also for the formation of the Methodist New Connexion, based on the principle already stated. Important questions are involved in the leading ground of difference between the two connexions—questions which relate to abstract theories of government in general, and the practical application of those theories; and not merely to these, but to the principles laid down in the New Testament respecting the distinctive character, proper functions, and consequent power of the ministers or pastors of the Christian church. It is fair to observe that the preachers constituting the conference of the Old Connexion, deny altogether the imputations officially brought forward against them by the advocates of the new system, of a fixed jealousy and dis-

trust of the people, and a degrading estimation of their ability and assistance. On the contrary they profess themselves, for Christ's sake, the willing and devoted servants of the people; the advocates of the old connexion, indeed, allege that their system, as now modified, secures to the body at large all needful religious privileges and advantages, by provisions, as closely connected with leading principles of the word of God, and as well adapted for perpetuity of vigorous operation, in repressing tyranny and arbitrary power, as were ever comprised in any human institutions. When divisions take place in any community, it is, doubtless, the peculiar business of the dissentients to establish a clear case of justification, and this principle is especially applicable when differences in theory, rather than any palpable grievances in practical administration, constitute the ground of proceeding, which, whatever ultimate good may be expected to result from them, stand connected with immediate evils of no trivial amount, when estimated in their religious bearings. Whether the remark is applicable to the formation of the Methodist new connexion, is a mooted point which we shall not attempt to decide; it certainly, however, is a truth of too correct application to the ecclesiastical history of our own times, that separating measures amongst religious bodies are far too readily adopted, and the evils resulting from them, to the general cause of Christianity, much too lightly appreciated. The abstract right of separating from any existing Christian community ought to be strenuously asserted, and kept inviolably sacred; but persons in a truly Christian frame of spirit will most reluctantly resort to its actual exercise.

It is, on all hands, allowed that since the period now treated of the Methodist body has been governed on wise, moderate, and conciliatory principles; and a disposition has been extensively acted upon to associate the people with the conference in the direction, so far as financial matters are involved, of all the great affairs of the connexion. The highly important department of foreign missions is placed under the actual management of a committee, composed of an equal number of ministers and laymen, who meet statedly for the transaction of its affairs at the Wesleyan mission house, 77, Hatton Garden, London; but the details of the progress of this great institution, we reserve for a distinct article. It has already been observed that the distinctive character of Methodism is to be sought for, not so much in its doctrines, as in the application which it studiously makes of them to produce lively impressions and immediate results. The numbers also whom, by the zeal and earnestness of its ministers, it brings to more serious and influential views of religion than they have previously entertained, it immediately subjects to a course of discipline at once calculated to unite them with the system by closest ties, and to call forth all their energies in its support and propagation. Thus, in the system of Wesleyan Methodism, we find that there exist, in addition to its itinerant preachers or regular ministers and the leaders of its classes, local preachers, exhorters, and prayer-leaders: these latter functionaries are employed in various services, such as their names denote, on the Lord's days, but at other times follow the ordinary occupations of life. Whatever be the supposed advantages or defects of this system, it will easily be seen to be admirably adapted to radiate and extend the form of Christianity which it embodies, wherever its operation is allowed. It is therefore no matter of surprise that the Wesleyan Methodists should have been eminently successful in their missionary operations; that the societies in close connexion with them in the West Indies, and especially in British America, Ceylon, South Africa, Australasia, &c., should include such rapidly increasing numbers, and exert an influence so generally beneficent and quickening upon other forms of Christianity.

At an early period of the history of the connexion, the attention of Mr. Wesley was directed to the British colonies on the North American continent. While the large tract of country to the north, constituting what is called New England, was generally provided with the institutions of Christianity; in the southern and middle states there was no provision to meet the spiritual exigencies of a rapidly extending population. In these vast regions, therefore, Methodism, or some similar system, was much needed, and it has been eminently useful. The connexion in the United States is much more numerous, both in itself and relatively to the general population, than in the British Islands. There are some varieties also in its discipline and government, the most material of which is the episcopacy of the American connexion. An American Methodist bishop, however, as presiding in the conferences, is rather a primus inter pares, first among equals, than resembling an English diocesan, recognised of an order essentially and scripturally distinct from that of Presbyters. The government of the American connexion, then, approximates to the model of archbishop Usher's reduced episcopacy, while that of the English body is purely presbyterian.

The Rev. Thomas Coke, LL.D. of Magdalen College, Oxford, who united himself with Mr. Wesley about the year 1781, made several voyages to America, and being appointed by Mr. Wesley one of the first general superintendents, afterwards denominated bishops, of the Methodist Church on that continent, was principally concerned in fixing the subordinate details of its government, in conformity with the leading regulations of the Methodist system. Proceeding on one of his voyages from England to the United States, in company with some other preachers or missionaries, the vessel in which they had embarked was driven by stress of weather to the West Indian archipelago, and the Dr. with his associates was ultimately landed in the island of Antigua. See the next article. So it came to pass that, while the Methodist body was prosecuting its first great religious undertaking without the limits of the British Isles, its attention was, in this remarkable manner, directed to a sphere of exertion in which, next to the North American continent, its missionary efforts have been crowned with the largest measure of success, and more

perhaps than in any other instance, produced the most advantageous results to the community at large. It is true that, at first, the Wesleyan missionaries met generally with every species of opposition and even legal persecution, in such degree and for such times as the colonial legislatures and magistrates were capable of inflicting it. But the enactments authorising such proceedings have been uniformly disallowed by his majesty in council; and the beneficial operation of the labors of the missionaries upon the character of thousands of the slaves, has, in the course of years, succeeded to a considerable extent in disarming the prejudices of many of the planters, and in securing for missions, conducted on principles at once so energetic and so wise, the warm patronage of many persons of respectability and influence, both in the colonies and at home.

For statistic details respecting the numbers in society, &c., on Wesleyan missions we must refer to the Minutes of the last conference: it may be proper to mention that the government on missionary stations is the same in form with that established in the connexion at home; but it is necessarily provided that there should exist a connexion more or less strict and immediate, according to circumstances, with the committee of management in Hatton Garden, whose proceedings are subjected to the final control and supervision of the conference.

The following is the 'General Recapitulation' of the conference of 1827.

		Nos.
Number of Members in Great Britain		237,239
Ditto in Ireland		22,599
Ditto in Foreign Stations		34,892
Under the care of the British and Irish Conferences		294,730
Under the care of the American Conferences in 1826		360,800
Total, exclusive of Regular Travelling Preachers		655,530
The Preachers of Great Britain are		
Regular Preachers	742	
Supernumerary and Superannuated	78	
		820
In Ireland.		
Regular Preachers stationed in the Circuits	86	
Missionaries	21	
Supernumerary and Superannuated Preachers	34	
		141
In the Foreign Stations.		
Regular Preachers and assistant Missionaries	165	
Supernumerary and Superannuated Preachers	4	
		169
In the American Connexion in 1826		
Regular Preachers in Circuits and Missionaries in the Indies	1319	
Supernumerary and Superannuated	87	
		1406
Total throughout the world		2536

It has not been our particular object, in this article, to present our readers with facts which in their proper details, as constituting parts of the regular history of Methodism, may easily be collected from any of the works professedly treating on the subject; but our design has rather been to furnish our readers with means for forming correct views on the peculiarities of this remarkable system. These appear to be but very imperfectly understood by the intelligent public of Great Britain. Their attention, indeed, is justly called to a system which alleges itself to be admirably adapted to varying places and circumstances; which is in one place merely a religious society, but in another place, where circumstances differ and seem to call for it, a proper and complete church; and which, in every mode of its existence, presents itself to all lovers of Bible Christianity, as adapted to promote their religious advantage in any way, and to any extent, that they may think fit to avail themselves of its aid.

We are indebted thus far for a sketch of Methodism to an able member of that community. Dr. Southey's late life of Mr. Wesley has brought forward the subject in circles where a living Methodist would be thought to spread a sort of contagion; and as his biographer is quite sure that Methodism frequently produced a bodily disease, 'peculiar and infectious,' we suppose that many persons will prefer to remain acquainted with it solely through the medium of books. For their sakes, and in justice to the poet laureate, as well as to one branch of Methodism that has been less under the observation of the candid writer of the foregoing sketch, we avail ourselves of some original observations on Dr. Southey's work which have already appeared in a deceased periodical, but which seem highly relevant to this interesting portion of modern ecclesiastical history.

'The name and character of Mr. Wesley,' says this writer, 'must ever occupy a large space in the religious history of the last century: but Methodism, which Mr. Southey has indefinitely associated with them, is often a very distinct subject. It will include the biography of Mr. Wesley as the founder of its more organised branch; but his history is by no means that of the singular revival of religion in England which has generally been designated by this name. He was but one of its great leaders and agents, who finally gave a distinct and permanent form to his work. The fruits of Mr. Whitfield's preaching in England, though it was of much shorter continuance than that of the Arminian leader, are to the present day, perhaps, at least equally extensive. In this country the Calvinistic Methodists are said nearly to equal the Wesleyans in number, and in Wales very considerably to exceed them. A succession, moreover, of regular clergymen, whose numbers have largely increased since his death, has been found to advocate the sentiments, and emulate the efforts, of this extraordinary man in the establishment. Like Toplady and Romaine, they are more scrupulous of trespassing upon order, and more cautious of their associates, than was Mr. Whitfield; but however they may have been improved, in modern times, by experience or by opposition, the

evangelical clergy were called into being by the example of this great founder of Calvinistic Methodism, a circumstance that adds considerably to its pretensions as a subject of history.

'We are now speaking merely to a few general facts of this theme.—The rise of Methodism was a revival of religion in England, whatever have been its irregularities and extravagancies. Since the Reformation there had been no efforts for religion equally extensive; no preaching so little sectarian; no preachers with equal claims to being the μαρτυρες of the faith. Churchmen and Dissenters were aroused from a common religious slumber by Methodism; it 'came up on the breadth of the land,' with a sound and a power to awake the dead. Could no other proof of this be adduced, Dr. Southey himself tells the world how much of the entire momentum of its modern zeal the established church, in particular, owes to Methodism. He observes, 'it may perhaps be said to be most useful' [as a stimulant, we suppose] 'where it is least successful' [as a sect]. Be it so. Never, we believe, was there a high church party in an establishment so truly anxious to sustain itself by argument, as modern times have seen in England;—by spiritual, rather than by temporal means. Never, for instance, so nobly zealous for the education of the poor, which will of itself outgrow any thing of a sectarian spirit that now mingles with it; and we hail, for our country, the more cheering aspect of beholding her dignified churchmen thus engaged, rather than in the low intrigues for the interests of tyranny and intolerance, in which some of them could associate even with infidels in the latter days of queen Anne. Methodists, however, led the way into this noble field of exertion; for Methodism awoke the established church to the value of public opinion, and dissenters to the importance of bold and united efforts of Christian zeal. * * * But Methodism, in its systematic form, soon grew too strong for a dependent, or even an auxiliary power. Opposition taught it its own resources; the contempt of some of the more enlightened classes of society happily united in throwing its light into the darkest corners of the realm; and in developing funds, talents, and powers, among the lowest orders of the people, to which statesmen and moralists had been alike blind for ages.

'Of the two leading *systems* of Methodism,' adds this writer, 'as they were left by their founders, our readers will judge according to their own habits and connexions; and many will attach a degree of importance to the doctrines in controversy between them with which no other part of either system, no better or worse modification of church discipline, will be thought to compare. Others will hail that which is at once common to both systems, and ever suited to the wants of a fallen creature—a testimony to the necessity of a change of heart in all men—as a light from heaven! The existing state of religious parties in England, at the period of the dawn of Methodism, will render this, we should be disposed to contend, the redeeming point of its early history. This, at least, was plainly preached throughout the land. Did it awake a thousand jealousies and evil passions, because it disturbed the profane in their works of darkness, and the pious in their dreams? Did it break through clouds, and call up clouds of error and enthusiasm, on its first appearance? Still it was the light of life. Angels minister the law no more. Every great moral reformation of mankind, since vision and prophecy have ceased, seems destined, by its innovations, its irregularities—and by some one capital feature of divine wisdom and simplicity pervading it—at once to attest its almighty author, and that he employs but human agents in its accomplishment—but ordinary human agents, as compared with the primitive teachers of Christianity. See the beautiful imagery of the Apocalypse, chap. xxi. 14–16. The reformation of Protestant Europe in the fifteenth, and of England from semi-popery and infidelity in the eighteenth century, both proceeded in this way. The one proclaimed its justification by faith, as the articulus stantis vel cadentis ecclesiæ; the other our Saviour's own introductory message—'Ye must be born again:' and each had its qualifying mixture of human imperfection and real fanaticism about it. The reformers could persecute, and the Methodist leaders throw their hearers into convulsions, and take pleasure in the success of their measures. We need not enquire which was the greater error.

'Are neither Whitfield nor Wesley entitled to be placed on an exact level with Martin Luther in history? Had they less general steadiness of character, less comprehension of mind, less caution? We must think so. But they were noble spirits, with all their human frailties. John Wesley would have done more for the highest interests of man, without the assistance of a Martin Luther, than Philip Melancthon; and with a Knox, a Zwingle, or a Bucer, the Methodist leaders may be honorably compared. The great peculiarities of the Christian faith, which they kept always in view, were singularly like the cardinal points of Luther's doctrine and early efforts. 'He pointed out the distinction between the law and the gospel,' says Melancthon; 'he refuted the Pharisaical error, at that time inculcated both in the schools and in the pulpit, that men may merit remission of sins by their own works, and become righteous before God. Thus he directed the minds of men to Jesus Christ; and, like John the Baptist, pointed to the Lamb of God who taketh away the sins of the world.' Could any language more aptly describe the state of religion in England at the period of which we are writing, and especially in that church in which the champions of Methodism arose? Some of the most popular sermons of the day, those of Atterbury, taught, 'That the virtue of charity [i. e. alms-giving, or at most a truly benevolent disposition] is of so great a price in the sight of God, that those persons who possess and exercise it, in any eminent manner, are peculiarly entitled to the divine favor and pardon, with regard to numberless slips and failings in their duty, which they may be otherwise guilty of: this great Christian perfection, of which they are masters, shall make many little imperfections to be overlooked and covered; it shall 'cover the multitude of sins.' What Melancthon proceeds to say of Luther might be

almost transcribed, word for word, into the history of either of these great Methodists. 'This revival of important truths procured him a very extensive authority, especially as his conduct corresponded with his instructions, and they proceeded not merely from the lip, but from the heart. This purity of life produced a great effect upon the minds of his hearers, and the old proverb was verified, Σχεδον, ὡς ειπειν, κυρωω τα την εχει πιστιν τὸ ἦθος. 'Piety makes the speech persuasive.' Wherefore many worthy men, influenced by the excellence of his doctrine and the sanctity of his character, were afterwards induced to comply with some of the changes which he introduced in certain established ceremonies. Not that Luther at that time meditated an innovation upon the customary observances, or broached any alarming opinions; but he was illustrating more and more the doctrines so essential to all, of repentance, the remission of sins, faith, and salvation by the cross of Christ.'

'Mr. Southey is evidently partial to Wesley: —he admires, but he neither loves nor venerates him; he reminds us of Erasmus's good opinion of Luther. 'God had sent him to reform mankind,' he owned, 'and the man's sentiments were true; but his course was invidious, because he at once attacks the bellies of the monks and the diadem of the pope. It grieved him that a man of his fine parts should be rendered desperate by the mad cries and bellowings of the monks.' The poet laureate may not thank us for the compliment; but we see very much of his temper respecting Mr. Wesley, as a whole, in the epistles of Erasmus to the elector of Saxony, and others respecting Luther. What said the reformer to all this? Just what a sensible Methodist might say to our biographer. 'I shall not complain of you for having behaved yourself as a man estranged from us, to keep fair with the Papists, our enemies. Nor was I much offended that in your *printed books*, to gain their favor, or to soften their rage, you have censured us with too much acrimony. We saw that the Lord had not conferred upon you the discernment, the courage, and the resolution to join with us—and therefore we dare not exact from you that which surpasses your strength and capacity. We even bear with your weakness, and honor that portion of the gift of God which is in you.' Luther's Letter to Erasmus, in 1524.

'For Mr. Whitfield, Mr. Southey has not even the cold and inconsistent admiration he expresses towards Wesley; and from Calvinism he is bigotedly averse. Having quoted from Mr. Wesley what he calls the sum of all that Zanchius and Toplady had said on predestination, our impartial biographer adds—'This is the doctrine of Calvinism, for which diabolism would be a better name; and, in the *worst* and *bloodiest idolatry* that ever defiled the earth, there is nothing so horrid, so monstrous, so impious as this.' (Vol i. p. 371). And this is 'neither extenuating or exaggerating any thing;' this is Mr. Southey's 'accuracy' in reporting on a controverted subject; Mr. Southey's 'sense of duty!!'

Some of the 'American Methodists,' not connected we believe with the episcopal and regular body, are called Camp Methodists, among whom are found the lesser tribes of Shakers, Jerkers, Rollers, Jumpers, &c.

METHODIST MISSIONARY SOCIETY.

METHODIST MISSIONARY SOCIETY. The missionary exertions of this large and respectable body of Christians were not reduced to system, nor were societies regularly organised for their support, until the year 1817. Yet missions to the heathen were commenced and superintended by the late Rev. John Wesley, founder of this religious community, and Dr Coke, one of its most useful and laborious ministers. As early as 1769 two missionaries were sent out to North America, and during the two following years four more sailed from England for the same country. In 1786 Dr. Coke and three other preachers were proceeding to Nova Scotia, but being compelled by stress of weather to steer for the Island of Antigua, and meeting with a very kind reception from the inhabitants, they considered these circumstances as a providential call to establish a mission among the negro slaves in the West Indies. Here too the way had already been paved for this effort of benevolence; for in 1769 Nathaniel Gilbert esq., who had experienced the power of religious truth in England, became a resident of this island, where he soon directed his attention to the spiritual welfare of its inhabitants. He first assembled a few persons together in his own house; and, finding his exertions eminently blessed, notwithstanding the situation he held as speaker of the house of assembly, he went forth boldly with a truly primitive zeal and holy courage, and preached the gospel to the poor negroes. 'A mode of conduct,' says Dr. Coke, 'so unprecedented in an exalted character soon excited surprise, surprise was followed by disapprobation, and disapprobation settled into reproach and contempt. Regardless, however, of the insults of those whose applauses he had not courted, he continued to persevere, and soon perceived he had not labored in vain. From among the number who attended on his ministry about 200 were joined in society, and manifested by their lives and conduct that they knew in whom they had believed.' The labors of Mr. Gilbert terminated but with his life; and, as he had no means of appointing a successor, his bereaved flock were left as sheep without a shepherd for a period of nearly twenty years. In 1778 Mr. John Baxter, a member of the Wesleyan connexion in England, removed to Antigua as a shipwright in the service of government. This good man took upon himself the care of Mr. Gilbert's society, and devoted all the leisure he

could command to the spiritual good of those around him; 'his usual method,' says one who has recorded the interesting tale, 'was to travel in the evening to the different plantations where the negroes were assembled to receive his instructions, and, after affectionately warning and exhorting them, he returned home, through those heavy dews which are so pernicious between the tropics, that he might be ready for the business of the ensuing day.' Thus, like a primitive apostle, while his own hand ministered to his necessities, he regarded not even his life to supply the lack of service to these destitute and friendless people. Through his superintendance, the assistance of Mrs. Gilbert, and the subordinate instrumentality of an old Irish emigrant who had come to the island in 1783, things went on so prosperously that they had had in their care upwards of 1000 members, chiefly blacks, who appeared anxious for all the blessings of our common Christianity. Many new places were opened for preaching, and the demand for instruction far exceeded the supply; losses were repaired by new admissions, and many happy deaths took place which demonstrated the power of the Christian faith and hope to animate the mind in that most solemn hour. In January, 1787, Dr. Coke resolved that Mr. Warrener, one of the missionaries originally appointed to Nova Scotia, should remain in Antigua, and Mr. Baxter resigned his lucrative situation as under store-keeper to devote himself entirely to the work of the ministry. In 1789 Dr. Coke again visited Antigua, and found 1000 members added to the society; and his testimony to the religious character and habits of the converted negroes deserves to be recorded in such a sketch as this. The Dr. observes 'Our blessed Lord, before he quitted for heaven, gave to his followers a new commandment, namely, that they should love one another, and perhaps we can find but few places in which this command has been more punctually obeyed than in Antigua. In times of sickness the members of our society visit each other with the most affectionate solicitude; in those cases where medical assistance is required by a patient who is unable to provide for it, it is instantly procured without any regard to expense. It may, indeed, be said that they live like brothers; that they are pitiful and tender hearted, and melt in sympathy at each other's woe.' A second visit (1790) amply confirmed the expectations of prosperity which this station had induced. In 1797 a missionary named M'Donald was sent out for Antigua; he encountered some very severe trials, when about ten leagues off Antigua they were attacked by a French privateer, captured, and confined about three weeks till an exchange of prisoners brought him aboard an English ship. Here the captain was desirous to secure his services as chaplain; but, this proposal being incompatible with his previous arrangements, M'Donald was put on shore in the island of Dominica, whence he gained Port Royal in Martinico. After a variety of sufferings and deprivations, he sailed to St. Pierres, and thence under convoy of an English privateer he arrived safely in St. John's harbour in Antigua. The death of Mr. Baxter took place in November 1805, and his remains were interred in the chapel. This event occasioned a temporary derangement of the affairs of this mission; the missionaries, however, were enabled to keep their ground, and in the course of a few years much good was done. They were, however, obliged to send repeatedly to England for additional aid, and more laborers. In April 1816 the island of Antigua was placed under martial law, in consequence of an insurrection which had broken out in Barbadoes; on this occasion Mr. Wooley, one of the missionaries, in company with his colleagues, went to the president and offered their services in any way that might be deemed serviceable to government. The reply was, an expression of thanks for the loyal offer, and an assurance that they could render more important service than that of bodily exercise; to which they in return assured him that their efforts should be directed to remove any unfavorable impression which the painful report might have induced to the prejudice of pure and undefiled religion. The close of the year 1818 proved an unusually sickly season; and Mr. David Jones, an excellent and promising missionary, was removed by death from the sphere of duty. In 1819, 1820, and 1821, we have, from authentic sources, accounts of the prosperity of the Antigua Sunday schools, confirmed by striking facts,—of the noble liberality of the inhabitants towards the erection of new school rooms, as the two in the town of Parham had been destroyed by a hurricane; and the formation of a missionary society in St. Johns, towards which the subscriptions and collections amounted to about £93, exclusive of trinkets which were offered towards this good work; this was soon followed by a branch missionary association in English Harbour, in which the negroes took a deep interest. The close of 1821 was marked by the conversion of a Mahometan negro, who was publicly baptised and renounced the delusions of the false prophet. In September 1822 a new place of worship was opened at Sion Hill; it had been erected by the proprietor, the Hon. J. D. Taylor, for the benefit of his negroes. The Christian benevolence of this excellent individual is thus noticed in the account of Mr. Whitehouse, one of the preachers:—'Among these negroes they appear rather as parents than proprietors; the sick are fed from their table, and they are building a hospital for lying-in women almost close to their own house, that Mrs. Taylor may have an opportunity of seeing them several times in the day.' In December Mr. Whitehouse laid the foundation stone of another chapel, in Willoughby Bay: on this occasion the Moravian missionary and his wife were present, together with several gentlemen from the different estates; and the negroes connected with the congregation of the Moravians at New Field brought a contribution of several loads of stones, some of which were already squared for use. The Annual Report of the present society for 1824 speaks of the divisions of this station, St. John's, English Harbour, and Parham, as generally prosperous and encouraging.

St. Vincent's.—In January, 1787, a pressing invitation induced Dr. Coke and three of his brethren, Messrs. Baxter, Clarke, and Hammet,

to visit this island. They were cordially received, a large warehouse was fitted up in Kingstown, and a promise given that the negroes should attend; rooms were appropriated for Mr. Clarke's use, who was to remain here; and the president of the council kindly permitted the use of the court-house, every Sabbath, for divine service. The negroes expected so much personal benefit from these new comers, and were so delighted with their visit, that some said, 'these men are imported for us.' In January Dr. Coke and the brethren left St. Vincent's, and Mr. Clarke remained to commence the labors of the Christian ministry; and on a second visit, in 1788, this mission presented a very favorable appearance. On this occasion Mr. Clarke accompanied the Dr. and his friends on a somewhat perilous journey to the Caribbean country, where Mr. and Mrs. Baxter took up their residence, but were eventually obliged to hasten from this department of the island through the fears and prejudices of the natives, who treated them as spies sent by the king of England to explore their territories. Amongst this people Mr. Baxter labored in vain, and failed to impress this roving people with the concerns of salvation; in the English division of the island the prospects were favorable. Two additional missionaries were appointed, and pursued their important work till 1792, when the secular arm interposed most unjustly to prevent the instruction of these poor negroes. A law was enacted, requiring a licence for all preachers, and twelve months' residence in the island was required to render the applicant eligible. From the plan of itinerating from place to place they knew that this law would effectually operate against the society's missionaries. For the first offence the punishment was by fine or imprisonment; for the second corporal punishment at the discretion of the court, and banishment; and finally, on return from banishment, death. This atrocious measure was hurried through the assembly, and very obnoxious to the people at large. Mr. Lamb, a missionary, was a victim to this oppressive enactment; he was seized and imprisoned, but afterwards released. On the return of Dr. Coke to England he presented a memorial to his majesty in council; enquiries were instituted; the reports were highly favorable to the character and conduct of the mission, and the act of the assembly was disannulled. 'Thus,' says the Dr., 'did religious liberty triumph over the private endeavours of oppressive violence, through the goodness of a king enthroned in the hearts of his people.' In 1794 this mission was renewed in the persons of Messrs. Owens and Alexander and their successors, who found ample employment, and pursued their course through evil and good report; through the difficulties and dangers which the habits and acts of this uncultivated people necessarily opposed to the promulgation of pure and primitive Christianity, of which wars with the Caribs, and an intolerant and persecuting spirit amongst the islanders, were the principal causes. 'Yet,' as one of the missionaries observes, 'notwithstanding these hindrances, God vouchsafes to convince the poor Africans of sin, and savingly converts them to himself; and some of them die, not only with a hope of heaven, but triumphing in full assurance' In the autumn of 1804 the West India Islands were visited by two tremendous storms of thunder and lightning: the door of a magazine, in Fort Charlotte, was wrenched open by the lightning, and, but for the interposition of divine providence, Kingstown, with all its inhabinants, would have fallen a sacrifice: for several hundred barrels of gunpowder were at the time in the fort. In 1815 the three missionaries, resident in St. Vincent's, took up their stations in three different parts of the island, and at this time the society consisted of about 800 members, all slaves. A recent insurrection in the island of Barbadoes furnished a pretext to the enemies of the gospel to bring the missionary system into discredit; and in 1816 the legislature intimated their intention to embarrass the mission; but the session passed without the adoption of any such measures. From this period to 1824 the intelligence received is favorable; and, during that year, 226 new members were admitted, and thirty-eight remained on trial as candidates for similar privileges.

St. Christopher's.—This mission commenced in January 1787. By a visit which Dr. Coke and others paid to the island great benefits were soon apparent from the introduction of the Gospel. In 1802 the members amounted to 22,587. In 1824 a branch missionary society was formed, on which occasion William Warton Rawlins, speaker of the house of assembly, presided; and in January 1825 a new place of worship was opened in the town of Basseterre, when his excellency the governor contributed to its erection, and, with his suite, attended at its dedication.

Barbadoes.—In December 1788 the indefatigable Dr. Coke directed his attention to this island, where, from his reception and other favorable circumstances, he anticipated for the mission a favorable prospect of success. Mr. Pearce, who accompanied the Dr., commenced his labors; but was soon exposed to violent opposition. Mobs were collected to disturb the worship, and volleys of stones were thrown against the doors; an appeal to the authorities led to the singular decision, that, as the offence complained of was committed against Almighty God, it was not within the jurisdiction of the magistrate! Thus were the assailants secretly encouraged; but a second application led to the apprehension and punishment of five of the rioters. This circumstance did some good, but the disaffection to the missionary labors exhibited a gloomy prospect for several years. In 1816 an insurrection broke out among the negroes: and this was falsely attributed to the preaching of the missionaries. The report of the committee, however, as might be expected, traced this mischief to far different causes. About the year 1820 the prospects began to improve. In 1821 an auxiliary society was instituted; and the friends of souls gradually surmounted opposition. In June 1822, at the anniversary of the missionary society, the chapel was overfilled; the collections doubled that of the preceding year, and even some Jews gave their silver and gold to further the good work. The sun, however

bright as it was, suddenly became eclipsed; and, about three months subsequently to this pleasing scene, a storm, which had long been gathering, suddenly burst with destructive fury. From personal abuse, and sinister encouragement, the populace proceeded to open violence; and, not contented with attacking the chapel, placed the lives of the worshippers in jeopardy. After the missionary had resided three years and a half in the colony, he was summoned to answer for not having enrolled himself in the militia; a petition to the council met with no attention; and, in the course of that very week, the mob levelled the chapel with the ground, and the poor servant of God and his family were compelled to escape to St. Vincent's to save their lives. After the departure of the principal persons the members of society who were left became the objects of lawless aggression. The destroyers of the house of God, says a minute historian of these transactions, on the 19th of October, 1823, resolved to celebrate the anniversary of the demolition of the chapel in honor of their signal triumph over methodism, and determined to end the anniversary by razing the dwelling house of one who yet dared to uphold this obnoxious system; and an appeal to the authorities led to the prohibition of any such meetings in future; while it protected the intended victim from the threatened outrage by the interposition of constables. Soon after these disgraceful scenes Mr. Buxton, the member for Weymouth, spontaneously brought the subject under the consideration of parliament; and, although Mr. Canning did not consider it advisable to adopt Mr. Buxton's resolution, the amendment which he substituted embraced all the strong points of the original motion, and was carried nem. con. This declaration of indignation by the British parliament, at such daring violations of the law, may be considered preparatory to the free enjoyment of religious worship, and the rights of conscience; and impose a powerful restraint on such rash acts of bigotry and intolerance.

Dominica.—In 1788 Mr. M'Conock was left in this island by Dr. Coke with a sufficient probability of success; but he fell a sacrifice to a malignant fever. Several missionaries followed in succession to this scene of labor; and in 1813 Mr. Willis, who was appointed to this station, narrowly escaped the effects of one of those hurricanes so common in this part of the world. In 1816 Mr. Boothby commenced his labors in Dominica; and, although he found things in a discouraging situation, his exertions were crowned with success. But his career was short; for, during the same year, he fell a victim to a severe cold, which, in ten days, destroyed his life. He had been well received by the inhabitants in general; and the governor of the island, with many other gentlemen, followed his remains to their last earthly resting place. In 1822 the earl of Huntingdon assumed the government of this island, and became the zealous patron of all attempts to better the moral condition of the people, and instruct the negroes in the truths of Christianity. In October of this year his excellency and suite, with many of the authorities, civil and military, were present at laying the first stone of a new Methodist chapel in Roseau. This chapel was opened in May 1823 under similar auspices. In 1824 Mr. Felous was zealously employed in instructing the negroes of the island of St. Joseph, where Roman Catholic superstitions are very prevalent. The recent intelligence is, that the new chapel in Roseau is well attended; that at St. Joseph there is an increase of members; and that, generally, the Dominica mission is in a prosperous and satisfactory condition.

Tortola.—Missionary exertions commenced in 1789, and Mr. Hammet was appointed to divide his labors between this and the adjacent islands of Santa Cruz, till other preachers should arrive from England. The preachers sent out to this part of the world are spoken of in high terms with regard to their loyalty, and the good effects of their labors on the minds of negroes, if considered only in a political point of view. In 1796 a Wesleyan chapel was erected in Spanish Town, and success followed the promulgation of the Gospel. In 1799 Messrs. Murdoch and Stengem were obliged to suspend their labors from illness. During this interval some irregularities appeared, and a spirit of insurrection broke out among the slaves; which, as usual, was laid to the charge of the instructions they had received. The missionaries, however, completely exonerated themselves. In 1804 Mr. Brennel succeeded Mr. Murdoch; but withdrew, in 1806, in consequence of a furious and brutal outrage, to which a faithful delineation of the character of these people, written to the directors in England, and the contents of which were known in Tortola, had given rise. In 1807 his colleague Mr. Evans died; and, in December, Mr. Hodgson succeeded him in his useful labors. The gratitude with which he was welcomed evinced the sincere attachment of the people to the ministry of the gospel. The effect of instruction on the morals of the slaves was strikingly beneficial. In speaking of the savage barbarities and impurities which were common among the negroes, it is added, in reference to a dance of a luxurious character: 'This diabolical custom is abandoned, and many of the slaves, who have received the truth in sincerity, relate, with feelings of horror, the part which they formerly bore in these detestable transactions.' A Sunday school was established on the Lancasterian plan, and made very considerable progress. In 1819 this mission suffered severely from the effects of a violent hurricane; all the chapels but one were destroyed, and the general loss of property was estimated at £100,000. When the news arrived in England about £2500 were liberally contributed to their relief, and the chapels were soon rebuilt. In 1823 a missionary auxiliary society was formed in Roadtown; and in 1824 the anniversary was honored with the presence of the president of the island and others, who not only contributed of their substance, but took an active part in the business, and appealed to known and authentic facts in support of their advocacy on behalf of the utility of missions in the West Indies.

Jamaica.—The mission to Jamaica commenced in 1789; Dr. Coke preached a few

times, and his account of the people is, that iniquity prevailed in all its forms; at the beginning the laborers in this vineyard had much to endure from persecution, opposition, and fatigue; abuse of all kinds was resorted to; but the fury abated gradually, and painful suffering was succeeded by useful and effectual exertion in the great and beneficial cause of pure Christianity. In June 1795 a dreadful conflagration broke out in the town at Montego Bay, on which occasion, though surrounded with symptoms of utter desolation, a man was heard to swear most profanely. A negro, who had listened attentively to the blasphemy and impiety, suddenly exclaimed, Oh Massa no use to curse and swear now, cursing and swearing do all dis! a conclusion worthy of the clearest intellect and the most pious Christian. In April 1797, when a subscription was set on foot to assist the mother country in carrying on the war, the members of various societies raised among themselves £150 in token of their duty and loyalty, and both whites and blacks, slaves and freemen, manifested equal zeal in the necessary exertions which this important crisis demanded. In the spring of 1802 some local preachers visited a village called Morant Bay, and, finding the people well disposed, formed a small society. The enemies of religion attempted to put them down by representing the preaching houses as nuisances, but in vain; the meetings were therefore continued with unabated zeal.

An event occurred at the close of this year which was productive of great evil, and arose from the wish to close at once all avenues of religious instruction to the slaves of this island. The legislative assembly passed a law, forbidding any but qualified persons to preach in any congregation of negroes or people of color, under severe penalties of fines, imprisonment, and hard labor. In Morant Bay Mr. Williams became a victim of this oppressive enactment, and at Kingston, Messrs. Campbell and Fish, supposing themselves shielded by their English licenses, continued their public labors without interruption, but when Mr. Campbell went to preach at Morant Bay he was committed to prison. The rigor, says Dr. Coke, which was aimed at by the new law, defeated the purpose for which it was passed, an application to the throne caused it to be forthwith disannulled; it had completely silenced all the local preachers, who returned to their labors with renewed vigor on its repeal. In Kingston an ordinance was passed by the corporation, which, although it recommended the instruction of slaves in the doctrines of the established church, prohibited the Wesleyan missionaries from teaching them by fines of £20 for every slave proved to be present at their meetings. The chapel was by these temporary and oppressive measures closed for several years. In 1815 it was re-opened by Mr. Shipman, who succeeded in obtaining a license, as did other of the society's missionaries, and in 1818 a second chapel was opened in Kingston, and licensed by the magistrates. The effects of divine truth on the slaves was soon obvious and beneficial. Their free countrymen, however, were too much wedded to their superstitions to reap a similar advantage. In 1821 this mission sustained a heavy loss by the deaths of two valuable missionaries, one of whom had spent eighteen years in the West Indies. Since this period several new stations have been added, as Port Royal, Stoney Hill, St. David's, Bath, Manchioneal, St. Ann's Bay, Bellemont, Goshen Estate, Guy's Hill, and Grateful Hill, and it is gratifying to learn that the congregations are numerous, the spirit of hearing very considerable, and the conduct of the people ornamental to their Christian profession.

Bermuda.—In 1798 application was made by a benevolent individual for a Wesleyan missionary, and in 1799 Mr. John Stephenson, a native of Ireland, proceeded from Dublin, through New York to this spot. He was met by the foolish prejudices of the inhabitants, who concluded as he was an Irishman he must be a rebel; this feeling gradually decreased, and in 1800 an increasing congregation and a new chapel were the pleasing proofs of the value of his services. Here, again, in a short time an obnoxious law, similar in its character to those noticed above, confined this servant of God in prison, brought him to trial and the alternative of fine or a long period of incarceration. An offer of liberty was subsequently made on condition that he should quit the island within sixty days, which he nobly spurned, and continued voluntarily a prisoner till the close of his allotted period. His health was hereby seriously undermined, and, as the legal valedictions prevented his labors, he was recalled in 1802. Here, again, an appeal to the good sense of his majesty's government at home led to the repeal of the obnoxious act, but the hostility of the people still continued. In 1808 another effort was made, and Mr. Marsden eventually succeeded in having a chapel erected, and a congregation established; and in 1811 the circulation of Bibles and tracts produced a mighty and pleasing moral transformation. In 1824 an admirable and just eulogy was pronounced on the missionaries of this society, at the annual meeting of the auxiliary society held at Hamilton in May, by the Hon. J. C. Eston, chief justice of the island, who presided on the occasion. 'I will maintain,' said he, 'that your missionaries in the scene of their operations, of all others the most interesting to us, I mean the West Indian colonies, have entitled themselves to the thanks of the established church, which they cannot without being calumniated be accused of undermining.'

Bahama Islands.—Mr. Turton, a West Indian, began to preach to the inhabitants of these islands in October 1801, and before the end of the year a chapel was opened in the eastern district with permission to instruct the slaves; he had to meet the frowns of the established clergy, but diligently persevered till 1804, when Mr. Rutledge arrived as his coadjutor; the sphere of their labors comprehended the adjacent islands of Exuma and Eleuthera. In 1811 the arrival of Mr. Dowton extended this sphere to Harbour Island, Abaca, and Providence Island: multitudes attended and much good was done. In 1816 a prohibiting edict interposed, and con

tinued in force about four years, but was afterwards repealed, when the missionaries became successful and the congregations increased. In 1824 a dreadful hurricane produced a most afflicting and calamitous scene in these islands.

St. Domingo -This mission may be dated from the year 1816, wnen Messrs. Brown and Catts were sent out to Port au Prince, the capital of Hayti in St. Domingo, an intimation having been received that the Protestant missionaries would not only be tolerated but patronised by government. In 1818 the prospects continued very encouraging; they had found access to the mountainous districts, and the congregations in the capital were very attentive, but in 1819 a reverse occurred, and they were obliged to quit a station where they had indulged the most pleasing anticipations of success; a party was formed to drive them from the island, although a military force was sent to protect them. His excellency the governor, however, thought for some reason that it was not expedient for them to preach any more; yet he gave a promise, since fulfilled, of presenting to the society a bill of exchange for £500 sterling. The missionaries removed from Port au Prince after two years labor, but left behind thirty approved members and eighteen on trial, under the care of two young men of promising talents. This society continued stedfast in their profession, but the spirit of persecution still continued, and many suffered much for the cause of their master; in 1824 we hear that this persecuted body had increased to ninety, and, although not allowed to hold public meetings for worship they continued stedfast.

In addition to the stations already noticed Wesleyan missions have been established in the islands of St. Eustatia, Nevis, Grenada, St. Bartholomew, Trinidad, Anguilla, St. Martin's, Tobago, and Montserrat, and in the colony of Demerara.

Mission to the island of Ceylon.—The great and generous Dr. Coke had offered to defray the whole outfit of the first missionaries to Ceylon and India. He at length induced the Wesleyan conference to sanction his plan; and, regardless of his own advanced years, he determined to accompany the persons destined to this station. In December 1813 he embarked at Spithead with six missionaries, and the fleet in which they sailed arrived in safety at its destination; part of the brethren sailed in the Cabalva, and part in the Lord Melville. One of the missionaries had to commit his wife to the mighty deep, and a still heavier calamity was in reserve; the venerable friend and father of this little band was suddenly removed by an apoplectic seizure, and they were compelled to proceed on their voyage and to the scene of their anticipated labors bereft of him whose knowledge, experience, and paternal character, were so desirable. On their arrival at Ceylon they experienced the most gratifying reception from the governor, the chief justice, the commandant, and the senior colonial chaplain. At the suggestion of the governor they agreed to separate to Jaffna and Batticaloa for the study of the Tamul language, and to Galle and Matura for that of the Cingalese; and it was further agreed that they should each undertake the superintendance of an English school at their respective stations, as this would introduce them, give them influence, and furnish an effectual method of learning the native tongue. Messrs. Lynch and Squance on their way to Jaffna were treated with great kindness at Colombo, the seat of government; and to their care a convert from Mahometanism who had been recently baptised was entrusted by the government for religious instruction. Soon after their arrival they were requested to perform divine service in the Fort Church, and they subsequently established a Sunday evening and week-day lecture; this, with other circumstances of a favorable kind, rendered the commencement of this mission most auspicious. In July Mr. Ault proceeded to his station at Batticaloa, and found the inhabitants heavily afflicted with sickness: the heat was excessive, and no suitable residence could at first be obtained. Some friends provided him an abode. His encouragement was considerable, and his congregations good; and, being anxious to promote the interests of the idolatrous natives, he studied hard at the Tamul language, and soon commenced his itinerations amongst the native huts. Mr. Erskine was gone to his station at Matura, the English school was opened, and in the Dutch Church he had a small and attentive congregation: he prepared himself for his future work by close attention to the Cingalese language. At Galle Mr. Clough continued to perform an English service in the Dutch Church every Lord's day, and this infant cause was essentially benefited by the decided patronage of lord Molesworth, whose influence exerted both in public and private produced the most gratifying results; the military became attentive auditors of the sacred truths of the gospel, and the mission presented a pleasing aspect: the indisposition of Mr. Harvard having detained him at Bombay he did not reach Ceylon till February 1814. On Christmas day in this year an idolatrous priest of Budha, who had arrived at a firm conviction of the truth of Christianity, amidst the violent opposition of some and the affecting entreaties of others, who were his relatives, was publicly baptised in the presence of a large congregation, his name was Petrus Panditta Sehara. This event produced a powerful sensation, and the fact was inserted in the Ceylon Gazette with an appropriate introduction by the governor himself. On account of the illness of Mr. Ault, which soon after terminated his life, Mr. Harvard was stationed at Colombo: here the government seminary contained many Cingalese youths, who, from the knowledge they possessed of the English tongue, were selected by the missionaries as interpreters of religious truth to their countrymen: here a Sunday school was established, and, on the arrival of a printing press, several thousands of elementary works were put in circulation; and a new and handsome chapel was erected, to which the public authorities and the archdeacon generously contributed. A person known by the appellation of the Ava priest became a convert to Christianity, and after a suitable probation was baptised by the name of Benjamin Parks. In the summer of 1815 this mission was strengthened by the arrival of five other missionaries, who were disposed of as

follows: Mr. Calloway to Matura, Mr. M'Kennie to Galle, Messrs. Broadbent and Jackson to Trincomalee and Batticaloa, and Mr. Carver to Jaffnapatam. In 1816 a school was established at Negombo, about twenty miles from the seat of government; and in 1817 a school-house was opened at Colpetty.

An anxiety which had been long felt to introduce the gospel into the Kandian territories was gratified in the year 1819; and in 1821 Mr. Newstead was enabled, by permission of the lieutenant governor and the friendship of Henry Wright, esq., to commence a missionary establishment at Kornegalle, a place considerably advanced in the Kandian territory; the beneficial results were soon apparent, especially in the strict observance of the Lord's day. On the 30th of December 1821 the first place of worship in the Kandian kingdom was publicly dedicated to the worship of the Most High, in the presence of a large assembly; the Te Deum in Cingalese was sung, and produced a very solemn effect. During this year the mission at Trincomalee sustained a great loss by the death of a native teacher who had recently been converted from heathenism to Christianity; as his illness became serious his relations and friends brought the heathen instruments wherewith they were accustomed to perform the ceremonies for the sick; he begged them to forbear, saying, 'What have I to do with these? I am a Christian—I am going to my Saviour—O Lord Jesus save me.' The death bed of this Christian believer was powerfully instructive. The last accounts from the different stations in Ceylon are in the highest degree encouraging to all who are interested in the promulgation of the Christain faith.

Missions in South Africa.—The benevolent exertions of the Wesleyan community were directed to this quarter of the world in 1816. Mr. Barnabas Shaw having previously attempted, but without effect, to obtain permission to instruct the slaves at Cape Town, directed his attention, with the approbation of the governor, to the interior of Africa. About this time Mr. Sohmlen, an agent of the London Missionary Society, arrived at the Cape with about a dozen others, and encouraged Mr. Shaw to proceed in his undertaking, at the same time promising to render him all the aid in his power. In the beginning of September they left Cape Town, and met six Hottentots, who had come from Namaqua Kraal, a journey of between 300 and 400 miles, to seek for some individual who might teach them the way of salvation. Receiving this incident as a token for good they proceeded on their way; and, when they had arrived at Namaqua Kraal, Mr. Shaw was left by his companions, who took their departure, and with only his wife as a companion was thus isolated in a strange land, surrounded by heathens, and comparatively ignorant of the language of the people. He instantly commenced his work; he soon collected a small congregation, and in May, 1817, began to instruct them in reading and agricultural pursuits. In June he baptised ten of these poor Hottentots, who gave proofs of the sincerity of their faith. In 1818 Mr. Edwards joined Mr. Shaw, and brought with him from the committee in London a quantity of iron for implements of husbandry. Repeated calls from the perishing heathen around them to come and preach to them the everlasting gospel was a loud appeal for additional help. Permission was obtained from the governor to establish a new settlement among the Bastard Hottentots at Reid Fountain; and on the arrival of Mr. and Mrs. Archbell, they occupied this new station; this took place on the 10th of August, 1819. In the month of March 1820 Mr. Shaw undertook a journey to some of the tribes beyond the Great Orange River, to explore the interior; and returned to Khamies Bay, after an absence of fourteen weeks. The account of this town, as contained in the Missionary Reports, is highly interesting. 'In the spring of 1821, on the arrival of Messrs. Broadbent, Hodgson, and Kay, it was determined to extend the Mission; and accordingly Mr. Archbell and a Hottentot assistant were sent among the Great Namaques—Messrs. Kay and Broadbent to the Bootchuana country—Mr. Hodgson remained at the Cape, and Mr. Shaw accompanied a party of settlers to Salem in Albany, about 100 miles from Algoa Bay. Here the sphere of usefulness was so extensive, that Mr. Threlfall was sent out to his assistance. The next point to which our missionary, Mr. Shaw, directed his attention was a mission among the Caffres; and in August 1822 he set out with two other missionaries and an interpreter on a visit to king Geika. To one of the missionary stations in Caffreland was given the name of Wesleyville, in honor of the founder of the society; and here the work of the ministry and the instructions of the natives proceeded in a pleasing and prosperous manner. This mission was strengthened in the month of March by the arrival of Mr. Whitworth; and they commenced a journey to the Tambookie country, to ascertain the disposition of the several chiefs as to the object of their mission. Here they found several fine openings, which invited their occupation; and at a district meeting in Albany in May, 1825, Mr. Kay was appointed to this service; and in company with Mr. Shaw proceeded to visit the chief Islambic. His sons conducted our missionaries to a spot on the banks of the rivulet Umkangisa, the most eligible situation for their purpose, to which they agreed to give the name of Mount Coke, in memory of the great and useful laborer in the Christian cause—the Rev. Dr. Coke.'

Mission in New Zealand.—The Wesleyan missionary, Mr. Leigh, who had been for some time stationed at New Zealand, sailed from Sydney in January 1822 for New Zealand, with a letter of introduction from the Rev. Mr. Marsden to the Church Missionaries stationed here. His first object was to attain a knowledge of the language, and teach the natives to read English. He found the New Zealanders very docile and attentive. Here he observed with much sorrow the grossness and absurdity of their opinions with regard to the Supreme Being, and the nature of the human soul, and the blood-thirsty cruelty which prevailed in this region of ignorance; but he occasionally had to rejoice in the attention and apparent interest with which

they listened to his instructions. In April 1823 he visited Ho-do-do in Doubtful Bay, and held some conversation with the natives. On his return he was joined by three fellow-laborers from England; illness obliged him to return to New South Wales, and two alone remained at Wangaroa on the river Thames, whose situation was at times very painful. In 1824 Messrs. Bennett and Tyerman being sent as a deputation to examine the Otaheitan missions, called at New Zealand on their way to Port Jackson, and whilst the Endeavour, the vessel in which they had arrived, was lying at anchor in Wangaroa, their lives were placed in great peril, but were mercifully delivered from the hands of these barbarians. On their arrival at New South Wales they communicated the result of their observations to the Wesleyan Missionary Society in London. A communication from Mr. Turner the missionary, in March 1825, states that some friends belonging to the Church Missionary Society, having heard of the perils in which they had been placed by the conduct of the inhabitants, had visited the station and decidedly recommended their immediate removal to the settlement; but when this communication was sent, Mr. Turner says, 'we now think it will be best to continue at our post for the present and quietly wait for the salvation of God.'

It only remains to be observed that, in addition to these several stations of active missionary exertion, the Wesleyan Society have others still in operation, the principal are, in America—Canada, Nova Scotia, and Newfoundland; in Western Africa, at Sierra Leone. In New South Wales—Van Diemen's Land, and the Friendly Isles. In Asia—Palestine and Continental India. In Europe—Ireland, France, Gibraltar, and Malta. In some of these stations much good has been done, in others the grain which has been sown is apparent only in the blade, but promises by and by to produce an abundant and glorious harvest.

METHODIUS, a father of the church, bishop of Olympus or Patara in Lycia, and afterwards of Tyre in Palestine. He suffered martyrdom at Chalcis in Greece towards the end of Dioclesian's persecution in the year 302. He composed many works, in a clear and elaborate style, which were extant in Jerome's time. F. Combesis collected several considerable fragments of this writer, cited by Epiphanius, Photius, and others; and printed them with some of his own, together with the works of Amphilochius, and Andreas Cretensis, in folio, Paris 1644.

METHUSELAH, Heb. מתושלח, or Mathusala, or Mathushelah, the son of Enoch, was born A.M. 687, begat Lamech in 874, and died in 1656, being the very year of the deluge, at the age of 969, the greatest age attained to by any man. Gen. v. 21, 22, &c. See ENOCH.

METIS (μητις, wisdom). The mother of Minerva, daughter of Oceanus and Tethys, the wisest of gods and men. The *Palus Mæotis* takes its name from her; and her sanctuary, where she was worshipped as the Great Mother, was at the mouth of the Borysthenes.

METIUS (Adrian), professor of mathematics and medicine at Franeker, was author of several treatises on astronomy and geography. He died at Franeker in 1635.

METIUS (James), brother of Adrian, said by some to have been the inventor of telescopes with glasses, one of which he presented to the States General in 1609, was born in Alcmaer.

METIUS SUFFETIUS, a general of the Albans, who, proving treacherous to Tullus Hostilius, the third king of Rome, was torn to pieces by horses. See ROME.

METO, or METON, was a celebrated mathematician of Athens, who flourished 432 years B. C. In the first year of the eighty-seventh Olympiad, he observed the solstice at Athens, and published his cycle of nineteen years, by which he endeavoured to adjust the course of the sun and moon, and to make the lunar and solar years begin at the same point of time. This is called the golden number, from its great use in the calendar. Meton was living about 412 B. C., for, when the Athenian fleet was sent to Sicily, he escaped a share in that disastrous expedition by counterfeiting insanity.

METŒCI, a name given by the Athenians to such as had their fixed habitations in Attica, though foreigners by birth. The metœci were admitted by the council of Areopagus and entered in the public register. They differed both from the πολιται and ξενοι; because the politæ or citizens were freemen of Athens, and the xeni or strangers had lodgings only for a short time; whereas the metœci, though not freemen of Athens, constantly resided upon the spot whither they had removed.

METONYMY, *n. s.* }
METONYM'ICAL, *adj.* } Fr. *metonymie*; Gr.
METONYM'ICALLY, *adv.* } μετωνυμία. A rhetorical figure, by which one word is put for another, as the matter for the materiate; thus, he died by steel, that is, by a sword.

METONYMY. See ORATORY.

METOPE, in architecture, the interval or square space between the triglyps of the Doric frieze, which among the ancients used to be painted or adorned with carved work, representing the heads of oxen, or utensils used in sacrifices.

METOPOS'COPY, *n. s.* Fr. *metoposcopie*; Gr. μετωπον and σκέπτω. Physiognomy; the art, if such there be, of knowing the characters of men by their countenance. An unnecessary word, whatever we may think of the art.

METRE, *n. s.* }
MET'RICAL, *adj.* } Lat. *metrum*; Gr. μετρον. See METE. Speech or written language confined to a certain number and harmonic disposition of syllables; verse; measure; numbers: metrical, pertaining to verse or metre.

Abuse the city's best good men in *metre*,
To laugh at lords.
Pope.

The establishing *metrical* psalmody in England

was the consequence of the Reformation and our communication with foreign Protestants.
Dr. A. Rees.

METRE. See POETRY.

METRODORUS, a Greek physician, born at Chios, was the disciple of Democritus the philosopher, and the master of Hippocrates the physician, and Anaxarchus the philosopher. He maintained that the universe was infinite and eternal; but his works are lost. He lived about 444 B.C.

METRODORUS, a celebrated philosopher and painter of Stratonice, who flourished about 170 A.A.C. Paulus Æmilius, after defeating Perseus, demanded of the Athenians a philosopher to instruct his children, and a painter to paint his temples; upon which they sent him Metrodorus, who satisfied him in both characters.

METRONOMII, the name given by the Athenians to five officers in the city and ten in the piræus, whose duty it was to inspect all sorts of measures, except those of corn.

METROP'OLIS, *n. s.* } Fr. *metropole;*
METROPOL'ITAN, *n. s.* & *adj.* } Lat. *metropolis;*
METROPOLIT ICAL. } of Gr. μητηρ, mother, and πολις, a city. The mother or chief city of a country or province: a metropolitan is the bishop of a mother church: as an adjective, metropolitan means belonging to a metropolis: metropolitical, chief or principal among towns or cities.

He fearing the power of the Christians was gone as far as Gratia, the *metropolitical* city of Stiria.
Knolles.

Their patriarch, of a covetous desire to enrich himself, had forborn to institute *metropolitan* bishops.
Raleigh.

He was promoted to Canterbury upon the death of Dr. Bancroft, that *metropolitan*, who understood the church excellently, and countenanced men of the greatest parts in learning. *Clarendon.*

His eye discovers unaware
The goodly prospect of some foreign land,
First seen: or some renowned *metropolis*,
With glistering spires and pinnacles adorned.
Milton.

We stopped at Pavia, that was once the *metropolis* of a kingdom, but at present a poor town.
Addison on Italy.

METROPOLIS is also applied to archiepiscopal churches, and sometimes to the principal or mother church of a city. The Roman empire having been divided into thirteen dioceses and 120 provinces, each diocese and each province had its metropolis, where the proconsul resided. To this civil division the ecclesiastical was afterwards adapted, and the bishop of the capital city had the direction of affairs, and the pre-eminence over all the bishops of the province. His residence in the metropolis gave him the title of metropolitan. This erection of metropolitans is referred to the end of the third century, and was confirmed by the council of Nice.

METTLE, *n. s.* } As Dr. Johnson thinks
MET'TLED, *adj.* } corrupted from METAL: but
MET'TLESOME. } the Belg. *moedwell*, and Teut. *mutwill*, signify animation; spirit; courage; sprightliness: mettled and mettlesome are, brisk; fiery; gay.

What a blunt fellow is this grown to be:
He was quick *mettle* when he went to school.
Shakspeare.

Oh thou! whose self-same *mettle*,
Whereof thy proud child, arrogant man is puft,
Engenders the black toad, and adder blue. *Id.*

Upon this heaviness of the king's forces, interpreted to be fear and want of *mettle*, divers resorted to the seditious. *Hayward's Edward VI.*

Such a light and *mettled* dance
Saw you never. *Ben Jonson*

He had given so frequent testimony of signal courage in several actions, that his *mettle* was never suspected. *Clarendon.*

Their force differs from true spirit, as much as a vicious from a *mettlesome* horse. *Tatler.*

Nor would you find it easy to compose
The *mettled* steeds, when from their nostrils flows,
The scorching fire that in their entrails glows.
Addison.

'Tis more to guide than spur the muse's steed,
Restrain his fury than provoke his speed;
The winged courser, like a generous horse,
Shows most true *mettle* when you check his course.
Pope.

But little wist she Maggie's *mettle*—
Ae spring brought off her master hale,
But left behind her ain grey tail:
The carlin claught her by the rump,
And left poor Maggie scarce a stump. *Burns.*

METTRIE (Julian Offray de la), M.D., a French physician, born at St. Maloes in 1709. He wrote the Natural History of the Soul, in which he denied its immateriality; and also a work against the physicians, for which he was compelled to leave France. He then retired to Leyden, where he wrote an atheistical work entitled L'Homme Machine, which was publicly burnt. He next went to Berlin, and was patronised by Frederick the Great. He died in 1751. His works were published in Berlin in 1 vol. 4to.

METZ, MEDIOMATRICES, DIVODURUM, or SOCIA CIVITAS, an ancient, large, and strong city in France, the chief place of the department of the Moselle, a post-town, and the seat of a bishop, containing 42,000 inhabitants. It is the principal military station of the third division, and has a royal court for the departments of the Moselle and the Ardennes; an inferior court; a chamber of commerce; and an exchange. Here is a royal school of artillery; also a university academy; societies of literature, arts, and sciences, and for the encouragement of agriculture and industry; a royal college; schools for drawing and painting, and mutual instruction in music; and public lectures in midwifery and botany.

This city is finely situated in a magnificent basin, at the confluence of the rivers Moselle and Seille. It is generally well built, and adorned with several excellent public edifices, particularly the governor's palace, the town-hall, court-house, military hospital, arsenals, college, assembly-room, a superb building, with a portico of the Tuscan order; and the cathedral, remarkable for the boldness, and yet astonishing lightness, of its architecture. The streets are broad, straight, and well paved, and next to Strasburg it is the best fortified place in France: there are seven gates, furnished with drawbridges; some of these

gates are double, treble, and even fourfold. The citadel, on the right bank of the Moselle, is capacious and very strong; and the ancient fortifications have been replaced by immense works constructed according to the modern system of defence, under the direction of marshals Vauban and Belleisle.

Metz was founded by the Gauls at a very early period, and was the capital of the Mediomatrices, a powerful nation of Belgic Gaul. It was a considerable place in the time of the Romans, who adorned it with several fine monuments. In 452 it was laid waste by Attila; afterwards the Franks invaded it, and it became the metropolis of the kingdom of Austrasia; it was successively subject to the emperors of Germany and the kings of France, till the eleventh century, when it became independent, under the protection of the empire, and enjoyed the privileges of a free city until the year 1552, when it again fell into the power of France, after Charles V. had besieged it with an army of 100,000 men, and been compelled to retire, having for sixty-five days assaulted it. It is the native place of Fabert, the illustrious warrior; of Adam Philippe Custine, commander-in-chief of the army of the north, executed at Paris on the 17th of August, 1793; of his son François Custine, who also suffered on the 7th of January, 1794; of Lacretelle the elder, distinguished for his learning; of the brothers Lallemand; and general Lasalle, who was slain at the battle of Wagram.

Manufactures are carried on here of coarse cloths, flannels, woollen stuffs, gold and silver lace, hats, embroidery, walking-sticks, paper-hangings, glue, &c. There are also cotton-spinning factories, numerous brass-foundries, starch, nail, and tile manufactories, and considerable tan-yards. The inhabitants trade in brandy, excellent beer, confectionary, drugs, spices, leather, iron and ironmongery, furniture, and timber of various sorts. Among the public places may also be mentioned the library, the cabinet of natural history, the botanical garden, the square of Croislin, and the esplanade, a very delightful walk. About five miles from the city, near the village of Jouy-aux Arches, are the remains of an aqueduct, which formerly served to conduct the waters of the Gorze to a naumachia toward the southern extremity of the town; seventeen arches are still standing, seven of which are entire. Metz is in long. 3° 51′ E., and lat. 49° 7′. Thirty-six miles south of Luxemburg, 123 north-west of Strasburg, and 237 east of Paris.

METZU (Gabriel), an eminent painter, born in Leyden in 1615. His subjects were usually taken from low life, and were all designed after nature, such as women selling fish, fowls, or hares; sick persons attended by the doctor; chemists in their laboratories; dead game, painters' shops, and drawing schools hung with pictures, &c. He died in 1658.

MEVANIA, in ancient geography, a town of the Cisappenine Umbria; seated at the confluence of the Tina and Clitumnus, on the Via Flaminia; famous for its herds of white cattle, brought up there for sacrifice. Mevania was the country of Propertius.

MEULEN (Anthony Francis Vander), a celebrated painter of battles, &c., born at Brussels in 1634. Some of his compositions, happening to be carried to Paris, were shown to M. Colbert, who soon discerned his abilities, and by his generous offers induced him to settle in Paris. Here he was employed by Louis XIV., and had a pension of 2000 livres beside payment for his work. He attended the monarch in most of his expeditions in the field, and designed on the spot the sieges, attacks, encampments, and marches of the king's armies; and from those sketches he composed the paintings which were intended to perpetuate the remembrance of those military exploits. He died in 1690. His chief works are at Versailles and Marli; but many of his easel pictures are dispersed through England, France, and Flanders.

MEURTHE, a department of France, consists of the southern part of the former province of Lorraine, and takes its name from the river Meurthe, which flows through it from south to north. The principal place of this prefecture is Nancy; it is divided into five arrondissements or subprefectures, Nancy containing 114,678 inhabitants; Chateau Salins 64,215; Luneville 73,817; Sarrebourg 64,780; and Toul 62,485; being a total population of 379,975 souls, on a superficial extent of 2790 square miles. These are subdivided into twenty-nine cantons, and 718 communes, yielding a revenue of 17,500,000 francs. It is in the third military division, having a royal court and a bishopric at Nancy, and is divided into three electoral arrondissements, which send five members to the chamber of deputies. This department is bounded by that of the Moselle on the north, on the east by that of the Lower Rhine, on the south by that of the Vosges, and on the west by that of the Meuse.

The face of the country is remarkable for the beauty of its scenery, and the variety of its productions; it is covered with mountains and hills, intersected by fine and fruitful plains, that are watered by the Moselle, the Sarre, the Meurthe. the Seille, the Verouze, the Madon, and the Mortagne, of which the Moselle and the Meurthe only are navigable here. Some of the hills are covered with vines, which produce good wine, the tops of the mountains are crowned with forests, and abound in excellent pastures. The soil of the plains, especially in the valley of the Meurthe and the Seille, is fertile in grain, of which a great quantity is exported. Hemp and flax also are successfully cultivated here, as well as wall-fruit trees, especially the apricot of Nancy. The meadows are rich and extensive, but the breed of horses and black cattle is small; the inhabitants are supplied with great quantities of fish from the rivers and ponds scattered over the country, and the forests abound in game of all sorts. There are likewise some mineral springs, and salt springs, that are very productive, and a stratum of rock salt, of an immense extent, of which the produce is incalculable. This country, which is rather stony, is cultivated by horses, and affords more than sufficient for its inhabitants; there are 218,980 hectars of forest land, chiefly oak and beech, and 13,500 hectars

of vineyards, the average produce of the hectar of arable land being 24 francs 12 centimes.

Besides the above productions, we may mention potatoes, beet-root, hops, rapeseed, plants of all sorts, excellent butter, horned cattle, merino and other sheep, goats, pigs, asses, mules, geese, bees, &c. There are also fine quarries of marble, freestone, graystone, grindstones, lithographic stones, earth for glass furnaces, and potter's clay. At Nancy there is a botanical garden, and a stud for horses at Bouxières. The inhabitants carry on manufactures of common cloths, hempen and cotton linen, embroidery of all kinds, playing-cards, paper-hangings, looking-glasses, crystals, pipes, liqueurs, mineral acids, candles, oil, basket-work, and turnery. They have also cotton-spinning factories, refining-houses for beet-root sugar, forges, bell-foundries, glass-houses, dye-houses, paper-mills, tan-yards, and potteries. Royal salt-works are established at Dieuze, Moyenvie, and Chateau Salins. In all the above articles a considerable trade is maintained with the whole country round.

This department is crossed by the great roads of Strasburg, Metz, Verdun, Bar-le-duc, Langres, Epinal, and Colmar.

Meurthe, the, a river in France, which, rising in the Vosges Mountains, at the back of Mount Bonhomme, divides itself into two streams, that descend the mountains of Valtin and Montaben, and unite below the bridge of Sandrouville, six miles to the south of St. Dié. It passes by Plainfaing, Faize, St. Marguerite, St. Dié, Raon-l'Etape, Baccarat, Luneville, Rosières, Dombasle, St. Nicolas, and Nancy, and falls into the Moselle below Frouard. This river flows at first with rapidity over a channel of gravel and flint, but it afterwards becomes more slow in its course, especially in the department to which it gives its name. It runs about 108 miles, receiving on its way the Verouze, the Mortagne, the Sanon, and several other small streams. It begins to be passable by rafts at Plainfong, in the department of the Vosges, and becomes navigable a little above Nancy. Along this river are conveyed chiefly fir timber in planks, which are sent down to Holland in floats of from 2000 to 3000 each, and fir wood.

MEURSIUS (John), a learned and laborious writer, born at Losdun, near the Hague, in 1579. He early discovered a fondness for the sciences; and at the age of sixteen he wrote a commentary on Lycophron. In 1610 he was made professor of history at Leyden; and afterwards Greek professor. In 1611 the magistrates of the United Provinces appointed him to write the history of his country. During fourteen years residence at Leyden he published more works than the whole body of professors had done from the foundation of the university in 1575. Christian IV. king of Denmark, in 1625, conferred on him the places of historiographer royal and professor of history and politics in the academy of Sora, where he resided twelve years. In 1638 he had a violent attack of the stone, from which he recovered, but died of a consumption induced by it on the 20th of September, 1639. He left behind him a son and a daughter. He was the author of many excellent historical, critical, and miscellaneous works; but the Meursii Elegantiæ Latinæ Sermonis, a scandalous indecent piece published in his name, was the production of one Westrenius, an advocate of Copenhagen.

MEUSE, a department of France, formed out of part of the former province of Lorraine, and taking its name from the river Meuse, which crosses it from south to north. The chief place of this prefecture is Bar-le-duc; it is divided into four arrondissements, Bar-le-duc, containing 76,889 inhabitants; Commercy 78,577; Verdun 74,426; and Montmedy 62,493; being a total population of 292,385 souls, on a surface of 2862 square miles. It consists of twenty-eight cantons, and 591 communes, yielding a revenue of 14,281,000 francs; and is part of the second military division, and of the diocese of Nancy, where there is also a royal court. It is further divided into two electoral arrondissements, which send four members to the chamber of deputies. This department is bounded on the north and north-west by that of the Ardennes, on the east by those of the Moselle and the Meurthe, on the south-east by that of the Vosges, on the south-west by that of the Upper Marne, and on the west by that of the Marne.

The face of the country is intersected with mountains, valleys, and plains; the mountains are lofty, covered with extensive forests, and abounding in game of all kinds; on the less elevated hills the vine is cultivated with success, and produces excellent wine, especially in the neighbourhood of Bar. The soil in the plains is in general poor and rather barren; but the valleys are exceedingly fruitful, yielding vast quantities of grain, rapeseed, flax, hemp, vegetables, and every sort of fruit. The Meuse is bordered with fine meadows and pastures, that feed a great number of cattle, in which the inhabitants carry on an extensive commerce. The ground, which is rather rocky, is cultivated with horses and oxen, and affords an ample supply for its inhabitants. There are 180,000 hectars of forests (oak, hornbeam, and beech), and 15,000 of vineyards, each hectare of cultivated land producing about 22 francs.

Besides what has been mentioned, this country produces fine red and white gooseberries, and fish of different sorts, especially trout and crabs. It has also numerous mines abounding in iron, and quarries of freestone, potters' clay, marl, and curious fossils. There are manufactures of cotton balls, cloths, and caps; casks, small shot, liqueurs, oils, and Gruyère cheese; cotton-spinning factories, forges, glass-houses, paper-mills, potteries, brass-foundries, tan-yards, and dye-houses, famous for the Adrianople red. In all the productions of these manufactories, as well as those of the soil, the inhabitants carry on a good trade.

The principal rivers that water this department are the Meuse, navigable; the Aire, the Ornain, the Chiers, the Ortain, the Saux, the Teinte, and the Orme. It is crossed by the great roads of Chalons-sur-Marne, Nancy, and Chaumont.

Meuse, the, a considerable river in France, which rises just above the village of Meuse, in the department of the Upper Marne. It is navigable from Verdun, in the department of the Meuse, as far as the frontiers of the kingdom, for an extent of about 150 miles, and from that place

Drawn by J. Aschetan.

London, Published by Thomas

Engraved on Steel by J. Shury.

Cheapside

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to its mouth, a further extent of nearly 200 miles. The Meuse, after passing by Bourmont, suddenly disappears at the village of Bargaille, about three miles from Neufchateau; it afterwards flows by Domremy, Vaucouleurs, Commercy, St. Michael, Verdun, Dun, Stenay, Mouzon, Sedan, Mezieres, Charleville, Monthermé, Revin, Fumay, and Givet; below this last town it enters the kingdom of the Low Countries, near Dinant, passes by Namur, Liége, Maestricht, Ruremonde, Vanlo, and Ravenstein; eighteen miles below this town it unites in two places with that arm of the Rhine which bears the name of the Waal, and is called for some distance the Merwe; at Dordrecht it separates into two streams, one of which resumes the name of the Meuse, and the other, retaining that of the Merwe, passes on to Rotterdam; these two branches unite again at some distance, opposite to Wardingen, and under the name of the Meuse fall into the North Sea, between the Breille and Gravesend. The whole course of this fine river is about 480 miles, receiving, in its progress to its mouth, the Chiers, the Semoy, the Lesse, the Sambre, the Ourth, the Boër, and many other streams.

MEW, *n. s.* & *v. a.* Fr. *mue;* barb. Lat. *muta*; Ital. *muta*. A bird-cage or coop; 'properly,' says Mr. Thomson, 'a receptacle for hawks changing their feathers, and a place for changing carriages, horses, and whatever belonged to the chaise.' Hence, therefore, our use of the term 'mews.' To confine or shut up; to shed the feathers or any outward attire or distinction, as the hawk and other birds.

Mewing, the falling off or change of hair, feathers, skin, horns, or other parts of animals, which happens in some annually, in others only at certain stages of their lives: but the generality of beasts mew in the spring. An old hart casts his horns sooner than a young one, which is commonly in February and March, after which they begin to button in March or April: and as the sun grows strong, and the season of the year advances, their heads grow, and are summed full by the middle of June.

MEXICO. The Republic of the United States of Mexico, in central America, comprise the former Vice-royalty of Spain, and is bounded on the north by the United States of America and the Gulf of Mexico; on the east by the United States, Gulf of Mexico, and Bay of Honduras; on the south by Guatimala; and on the west by the Pacific Ocean; it is situated between lat. 15° and 42° N. and between long. 87° and 124° E. It extends 1850 miles in length, by about 1000 in breadth and contains an area of 1,690,000 square miles. The population exceeds 7,000,000 of inhabitants. Its geographical features are peculiar: embracing every species of soil, from the most recent alluvial to mountain valleys, or rather plateaus, elevated nearly 8000 feet above the sea. These plains are again broken by colossal masses, rising from twelve to seventeen thousand feet. From the difference of elevation, and from the extensive range which it embraces within the tropics, Mexico may be considered to possess every climate of the earth, and to be capable of producing every species of vegetable necessary to the wants or sought by the luxuries of human life; and from the great internal capability of production it follows, that few parts of the globe are better calculated to compose one independent political community. The mineral treasures of this country are perhaps its most important. They are placed within the valleys of the great mountain chains; and the richest mines of Mexico, those of Real del Monte, Guanaxuato, Tasco, and Zacatecas, are situated at an elevation of from five to six thousand feet above the sea. Gold is found in little straw-like fragments, and native silver in great abundance. Some of these mines have been worked to extraordinary depths: one in particular is excavated to the depth of 1640 feet, and its galleries extend a length of eight miles. The agricultural produce is of the most luxuriant kind, and raised with little labour. Wheat, rye, and barley are extensively cultivated, besides, two and three crops of each are taken annually. Logwood and mahogany are cut in the districts of Campeachy and Honduras, and cocoa and cochineal form articles of export, and here also grow the trees yielding the balsam of capaiva and tolu. Mexico possesses but few good harbours; Vera Cruz and Tampico, on the Gulf of Mexico, are the most frequented on the east shore, and Acapulco and San Blas on the west. The territorial sub-division of the Republic includes 18 intendancies and 3 territories. The former are named Mexico, Puebla, Guanazuato, Jalisco, Oajaca, Yucatan, Zacatecas, Michoachan, Durango, Vera Cruz, San Luis Potosi, Chihuahua, Queretaro, Chiapas, Tabasco, Tamaulipas, Nuevo Leon, Coahuila, Sonora, and Sinaloa. The territories are those of New Mexico, Alta California, and Baja California. The little territories or districts of Tlaxcala and Colima, consist of those cities respectively, with a small extent of contiguous country. In 1519, Cortez and his Spanish followers discovered Mexico, and founded Vera Cruz. The country was then governed by Montezuma; after his death, in 1520, Mexico was seized by the Spaniards, and Cortez became Captain-General of New Spain (Mexico) until 1535, when he was displaced by a Viceroy. The country may be said to have groaned under Spanish misgovernment, or to have lain exhausted, for three centuries: after which it at length arose from its lethargic and fallen state, and in 1821 declared itself totally independent of Spain, and formed its numerous provinces into the federal republic of Mexico. The capital of the new republic is the city of Mexico.

Mexico, a city of North America, the capital of the country of this name, is the oldest city of the New World of which we have any account. The original town, called by the natives Tenochtitlan, was founded in 1325 in the valley of Mexico on a group of islands in the lake Tezcuco. Three principal causeways of stone and earth connected it with the mainland. They were thirty feet wide, we are told, and of great length; the western one, or that of Tacuba, being a mile and a half; that of Tapeaca, on the north-west, three miles; and that of Cuoyacan, towards the south, six miles long. The bases of them

[illegible], and form, with some modern additions, [illegible] paved ways across the marshy grounds, [illegible] the city from being overflowed by the neighbouring lakes. The old city is said by Cortez, in a letter to Charles V., to be as large as Seville or Cordova. 'The streets, I merely speak of the principal ones,' he writes, 'are very narrow and long; some are half dry and half occupied by navigable canals, furnished with very well constructed wooden bridges, broad enough for ten men on horseback to pass at the same time. The market-place, twice as large as that of Seville, is surrounded with an immense portico, under which are exposed for sale all sorts of merchandise, eatables, ornaments made of gold, silver, lead, pewter, precious stones, bones, shells, and feathers; delft ware, leather, and spun cotton. We find hewn stone, tiles, and timber, fit for building. There are lanes for game, others for roots and garden fruits: there are houses where barbers shave the head with razors made of obsidian; and there are houses, resembling our apothecaries shops, where prepared medicines, unguents, and plasters, are sold. There are houses where drink is sold. The market abounds with so many things that I am unable to name them all to your highness. To avoid confusion, every species of merchandise is sold in a separate lane; every thing is sold by the yard, but nothing has hitherto been seen to be weighed in the market. In the midst of the great square is a house, which I shall call l'audiencia, in which ten or twelve persons sit constantly, for determining any disputes which may arise respecting the sale of goods. There are other persons who mix continually with the crowd, to see that a just price is asked. We have seen them break the false measures which they had seized from the merchants.'

This city was taken by Cortez, as we have seen, in the year 1521, after a siege of seventy-five days. The Spaniards were so irritated at this protracted resistance that they resolved to raze it to the ground, and, especially as the destruction of the streets on the exterior facilitated their approaches to the other and main parts of the town. The ancient Tenochtitlan was thus completely levelled, and the present city has risen from the ruins, although, from the diminution of the waters of the lake Tezcuco, it is situated about a league distant from its shore.

The valley in which it stands is nearly in the middle of the Cordillera of Anahuac, on the ridge of mountains which runs to the N.N.W. It is surrounded with an oval barrier of mountains, which inclose it like a wall, and is eighteen leagues and one-third in length, and twelve and a half in breadth. Baron Humboldt ascertained it by barometrical survey, to be raised to the height of 7200 feet above the level of the sea. At this elevation the city, notwithstanding its tropical position, enjoys a temperate climate, and even a considerable degree of cold is felt, from winds which at certain seasons burst from the north; the thermometer having been known at these times to fall below the freezing point. But this is rare; the winters are usually as mild as at Naples. In the cold season the mean heat is from 55° to 70° of Fahrenheit's thermometer: the thermometer in summer never rises above 75°. The whole neighbourhood, except on the east side, which is in fact the old bed of the lake and is impregnated with saline particles, is laid out in estates in the highest cultivation; orchards and gardens pour in a continual supply of fruits, flowers, and vegetables of all kinds, for the use of the inhabitants: the plan of the city is a square, extending from north to south, and from east to west, about four English miles. The streets are drawn at right lines, and are very spacious: the ground on which it stands quite level. It is surrounded with a wall of uncemented stone; and various small canals disperse the waters of the lake through some beautiful streets. In a great central square is the viceroy's palace: and there are different markets, where there is a regular supply of all the necessaries and luxuries of the climate. The chief public buildings whose magnificent architecture attracts attention are, 1. The cathedral, partly in the Gothic stile: the body of the edifice having two towers ornamented with pilasters and statues of very beautiful symmetry. 2. The treasury, adjoining the state palace. 3. The great convent of St. Francis, which from alms alone once possessed a revenue of £20,000 sterling. 4. The two united hospitals, of which the one maintains 600, and the other 800 children and old people. This noble establishment has a revenue of £10,000 a-year. 5. The accordada, or prison, in which the apartments are generally spacious, and in which they reckon that more than 1000 individuals are often confined. 6. The school of mines; and the whole provisory establishment, with its collections in physics, mechanics, and mineralogy. 7. The university and its public library. 8. The academy of fine arts, with a collection of ancient casts. 9. The sepulchral monument consecrated to Cortez, in a chapel of the Hospitale de los Naturales. 10. The mint of Mexico, said to be the largest and richest in the world. It is a building of very simple architecture, belonging to the palace; but its interior arrangements are very superior. It was begun in the year 1535; the coinage being at first carried on by individuals to whom the government farmed it; but since 1733 all the works have been placed under the direction of government officers. The number of workmen employed has often amounted to 400; and it is possible to coin here with ease pieces to the amount of £30,000,000 annually.

The chief manufactures carried on in Mexico are the printing of calicoes, manufactures of cloth, hard soap, and tobacco, which last was long a royal monopoly: the working of gold and silver, in its various branches, is also carried to great perfection. Wrought plate, vases, and church ornaments, were annually executed before the revolution to a great amount; and great taste was displayed in the execution of them.

Mexico is favorably situated for carrying on commerce both with Europe and Asia. Equally distant (i. e. about sixty-nine leagues) from the port of Vera Cruz on the east coast of America, and from Acapulco, the port on the western shore it is a central point between these two great continents, and well adapted for becoming a great depôt of their produce. At present the difficul-

ties of the roads, and the unsettled state of the governments around, alike present great obstacles to free internal intercourse.

According to the latest data, the population of this city, including military, appears to be from 135,000 to 140,000 souls, in something like the following proportion:

Europeans	2,500
White Creoles	65,000
Indigenous copper colored . .	33,000
Mestizoes, mixture of whites and Indians	56,000
Mulattoes	10,000
Total	166,500

The clergy, until very lately at least, formed a numerous and powerful body, amounting, including all descriptions, to 2392. The archbishop possessed revenues equal to £18,000 per annum.

MEXITLI, a god of war among the ancient Mexicans. The worship of this idol was most horribly bloody. Numberless human sacrifices were offered up at his shrine. Clavigero and bishop Zumarraga say, that 20,000 persons were annually sacrificed to this idol in Mexico alone. Gomara makes the number 50,000. The breasts of the victim were cut open alive, and their hearts torn out and sacrificed.

MEYER (Felix), an eminent landscape painter, born at Winterthur in 1653, and taught by a painter at Nuremburg. He was afterwards a disciple of Ermels, whose style he followed. In search of still greater improvement, however, he travelled to Italy; but, the climate not agreeing with his constitution, he retired to Switzerland, where, as he was indefatigable in surveying all the beauty, the wildness, and the magnificence of nature in those romantic scenes, he made a multitude of noble designs, which procured him very high reputation. But he was not expert at painting figures. Such of his landscapes as were supplied with figures by Roos, or Rugendas, are most esteemed. He died in 1713.

MEYER (James), a Flemish historian, born in 1491 near Ballieul, whence he is also named Baliolianus. He was rector of Blankenberg, and wrote, 1. Annales Rerum Flandricarum, fol. 2. Flandricarum Rerum Decas, 4to. He died in 1552.

MEYNT, or MEINT, *part. adj.* From Sax. menᵹe, to mingle. Mingled. Obsolete.

For even of love the sicknesse,
Is *meint* with swete and bitternesse. *Chaucer.*

The salt Medway, that trickling streams
Adown the dales of Kent,
Till with the elder brother Thames
His brackish waves be *meynt*.
Spenser's Pastorals.

MEYWAR, an extensive district of Hindostan, in the province of Ajmeer, situated between 25° and 26° of N. lat. It is possessed by a number of Rajpoot chiefs, dependent on the rajah of Odeypore, and is in general hilly, but produces sugar, tobacco, cotton, and grain; horses, camels, and cattle. Its principal manufactures are swords, matchlock musquets, and cotton cloths. The chief towns Odeypore, Shahpoorah, and Bilarah; its largest river is the Banasa.

MEYWAT, a district of Hindostan, in the province of Delhi, is situated between 27° and 29° of N. lat.; and, although within twenty-five miles of the capital of India, its inhabitants have always been described as singularly savage and brutal; so that the epithet of Meywatty has become synonymous with that of robber. This district has changed masters often enough perhaps to account for this: it is now nominally possessed by the Machery rajah, whose capital is the town of Alvar.

MEZANDERAN, a province of Persia, bounded east by Chorasan, south by Chusistan, Irak, west by Chilan, and north by the Caspian Sea. The south part is mountainous but very healthful; the north is so extremely fertile that it is styled the garden of Persia. Silk is the chief manufacture. Ferbad is the capital.

MEZENTIUS, in fabulous history, a king of the Tyrrhenians, infamous for his cruelties. Among other barbarities he tied the living and the dead together. Being expelled by his subjects he fled to Turnus, and fought under him against Æneas, by whom he was killed, with his son Lausus.—*Virg. Æn.* vii. 648, &c.

MEZERAI, or MEZERAY (Francis Eudes de), an eminent French historian, the son of Isaac Eudes, a surgeon, born at Rye, in Lower Normandy, in 1610; and who took the surname of Mezeray, from a hamlet near Rye. Having studied at Caen, he discovered a strong inclination for poetry; but going to Paris he applied himself to politics and history, and procured the place of commissary at war, which he held for two campaigns. He then shut himself up in the college of St. Barbe, in the midst of books and MSS., and, in 1643, published the first volume of the History of France, in folio; and, some years after, the second and third. He surpassed all who had written the History of France before him, and was rewarded by the king with a pension of 4000 livres. In 1668 he published an Abridgment of his History of France, in 3 vols. 4to, which was well received by the public; but as he inserted in that work the origin of most of the taxes, with very free reflections, M. Colbert complained of it, when Mezeray promised to correct what he had done in a second edition; but, those corrections being only palliations, the minister caused half of his pension to be suppressed. Mezeray complained of this in very severe terms; when he obtained no other answer than the suppression of the other half. Vexed at this treatment, he resolved to write on subjects that could not expose him to such disappointments; and composed his treatise on the Origin of the French. He was elected perpetual secretary to the French academy; and died in 1683. He is said to have been so careless in his dress that he often passed for a beggar, and was one morning actually seized by the parish officers; which was so far from provoking him that he was highly diverted with it, and told them that 'he was not able to walk on foot, but that, as soon as a new wheel was put to his chariot, he would attend them wherever they thought proper.' With regard to religion he affected Pyrr-

honism; which, however, was not so much in his heart as in his mouth. This appeared from his last sickness; for having sent for those friends who had been the most usual hearers of his licentious conversation about religion, he desired them 'to forget what he might formerly have said upon the subject of religion, and to remember that Mezeray dying was a better believer than Mezeray in health.' He also wrote, 1. A Continuation of the History of the Turks. 2. A French translation of John de Sarisbury's Latin treatise on the vanities of the court. 3. Several satires against the government, under the name of Sandricourt.

MEZE'REON, *n. s.* Arab. *mezereon.* Daphne or spurge laurel.

Mezereon is common in our gardens, and on the Alps and Pyrenean mountains: every part of this shrub is acrid and pungent, and inflames the mouth and throat. *Hill.*

Mezereon too,
Though leafless, well attired, and thick beset
With blushing wreaths, investing every spray.
Cowper.

MEZEREON. See DAPHNE.

MEZIERES, a small but strong town, the principal place of the department of the Ardennes, in France, possessing societies of agriculture, arts and sciences and commerce. It is a post-town, and of the fourth division, with an inferior court at Charleville, and contains 3,600 inhabitants; it is situated at the foot of a hill on the right bank of the Meuse, which divides it from Charleville; it is surrounded with considerable fortifications, and defended by a citadel. It is very confined, and in general badly built. In the year 1521 it was besieged by the emperor Charles V. with a powerful army, and bravely defended by the chevalier Bayard. In has, indeed, never been taken. Here are some famous tan yards, brass foundries, and edge-tool manufactories; and a trade is carried on in leather, serges, hats, linen, &c. The public library contains 4000 volumes. This town is fifteen miles W. N. W. from Sedan, sixty north-east from Rheims, and 177 north-east from Paris; in east long. from that city 2° 23', and N. lat. 49° 51'.

MEZIRIAC (Claude Gasper Backet sieur de), an ingenious author of the seventeenth century, was born at Bresse of an ancient and noble family. He was an excellent grammarian, a Greek scholar, and an admirable critic. He was deeply skilled in algebra and geometry, of which last he gave proof by publishing the six books of Diophantus, with a very able commentary and notes. In his youth he spent a considerable time in Paris and in Rome; at which last place he wrote a small collection of Italian poems, in competition with Vaugelas, who was there at the time; among which there are imitations of the most beautiful similies contained in the first eight books of the Æneid. He also translated Ovid's Epistles; a great part of which he illustrated with very curious notes. He began a translation of Plutarch's works, with notes; which he had nearly finished, when he died at Bourg in Bresse in 1638, aged forty-five. He left behind him several finished works in MS.

MEZUZOTH, in the Jewish customs, pieces of parchment which the Jews affixed to the door-posts of their houses, taking literally that precept of Moses, 'Thou shalt never forget the laws of thy God, but thou shalt write them upon the posts of thy house, and on thy gates.' But, in order to avoid the profanation of the wicked, they wrote these words upon a square piece of parchment prepared on purpose, with a particular ink, and a square kind of character: Deut. vi. 4, 5, 6, 7, 8, 9. 'Hear, O Israel, the Lord our God is one Lord,' &c. Then they left a space, and afterwards went on, Deut. xi. 13, 'And it shall come to pass, if thou shalt hearken diligently to my commandments,' &c. as far as, 'Thou shalt write them upon the door-posts of thy house,' &c. After this they rolled up the parchment, and put it into a case, on the end of which the word Shaddai, one of the names of God, was written; and they put it at the doors of their houses, chambers, &c. and fixed it to the knockers of the door, on the right side; and, as often as they entered in or went out, they touched it in this place with the end of their finger, which they afterwards kissed out of devotion. The Hebrew word mezuza properly signifies the door-posts of a house; but it is also given to this roll of parchment now mentioned. Leo of Modena may be consulted on this custom.

MEZZOTINTO is a particular manner of representing figures on copper, so as to form prints in imitation of painting in Indian ink. This invention has been attributed to prince Rupert. But baron Heinikin, a very judicious writer upon engraving, asserts, with great appearance of truth, that it was a lieutenant-colonel de Siegan, in the service of the landgrave of Hesse, who first engraved in this manner; and that the print which he produced was a portrait of the princess Amelia Elizabeth of Hesse, engraved in 1643. Prince Rupert learned the secret from this gentleman, and brought it into England, when he came over the second time with Charles II. Prince Rupert's print of an executioner holding a sword in one hand and a head in the other, a half length, from Spagnoletto, is dated 1658. This art has never been cultivated with success in any country but in England. The prince laid his grounds on the plate with a channelled roller; but one Sherwin, about the same time, laid his grounds with a half round file, which was pressed down with a heavy piece of lead. Both these grounding-tools have been laid aside for many years; and a hand-tool, resembling a shoemaker's cutting board knife, with a fine crenelling on the edge, was introduced by one Edial, a smith by trade, who afterwards became a mezzotinto painter. It is very different from the common way of engraving. To perform it, they rake, hatch, or punch the surface of the plate all over with a knife, or instrument made for the purpose, first one way, then the other, across, &c., till the surface of the plate be thus entirely furrowed with lines or furrows, close, and, as it were, contiguous to each other; so that if an impression was then taken from it, it would be one uniform blot or smut. This done, the design is drawn or marked on the same face; after which, they proceed with burnishers, scrapers, &c., to expunge and

take out the dents or furrows, in all the parts where the lights of the piece are to be; and that more or less as the lights are to be stronger or fainter; leaving those parts black which are to represent the shadows or deepenings of the draught. As it is much easier to scrape or burnish away parts of a dark ground corresponding with the outline of any design sketched upon it, than to form shades upon a light ground by an infinite number of hatches, strokes, and points, which must all terminate with exactness on the outline, as well as differ in their force and manner; the method of scraping, as it is called in mezzotinto, consequently becomes much more easy and expeditious than any other method of engraving. The instruments used in this kind of engraving are cradles, scrapers, and burnishers. In this engraving, the plate must be prepared and polished in the same manner as for other engraving; and afterwards divided equally by lines parallel to each other, and traced out with very soft chalk. The distance of these lines should be about one-third of the length of the face of the cradle which is to be used; and these lines should be marked with capital letters, or strokes of the chalk. The cradle is then to be placed exactly between the first two lines, and passed forwards in the same direction; being kept as steady as possible, and pressed upon with a moderate force. The same operation must be repeated with respect to all the other lines; till the instrument has thus passed over the whole surface of the plate. Other lines must be then drawn from the extremities of the other two sides, in the same manner; which, intersecting the first at right angles, will with them form squares; and the same operation must be repeated with the cradle as in the case of the first. New lines must then be drawn diagonally, and the cradle passed betwixt them as before; and, when the first diagonal operation is performed, the lines must be crossed at right angles as the former, and the cradle passed betwixt them in the same manner. The plate having undergone the action of the cradle, according to the disposition of the first order of lines, a second set must be formed, having the same distances from each other as the first. But they must be so placed as to divide those already made into spaces one-third less than their whole extent; i. e. every one after the first on each side will take in one-third of that before it, e. g. beginning at A, of which the first third must be left out; a third of B will consequently be taken in, and so of the rest. These lines of the second order must be marked with small letters, or lesser strokes, to distinguish them from the first; and the same treatment of the plate must be pursued with respect to them as was practised for the others. When this second operation is finished, a third order of lines must be made; the first of which, e. g. in A, must omit two-thirds of it, and consequently take in two-thirds of B, &c. By these means the original spaces will be exactly divided into equal thirds; and the cradle must be again employed betwixt these lines as before. When the whole of this operation is finished it is called one turn; but, in order to produce a very dark and uniform ground, the plate must undergo the repetition o all these several operations for above twenty times; beginning to pass the cradle again betwixt the first lines, and proceeding in the same manner through all the rest. When the plate is prepared with a proper ground, the sketch must be chalked on it, by rubbing the paper on the back side with chalk. It is also proper to overtrace it afterwards with black-lead or Indian ink. The scraping is then performed, by paring or cutting away the grain of the ground in various degrees; so that none of it is left in the original state, except in the touches of the strongest shade. The general manner of proceeding is the same as drawing with white upon black paper. The masses of light are first begun with; and those parts which go off into light in their upper part, but are brown below: the reflections are then entered upon; after which the plate is blackened with a printer's blacking-ball made of felt, to discover the effect; and then the work is proceeded with, observing always to begin every part in the places where the strongest lights are to be. The art of scraping mezzotintoes has been applied to the printing with a variety of colors, in order to produce the resemblance of paintings. The inventor of this method was J C. Le Blon, a native of Frankfort, and pupil of Charles Marata, between 1720 and 1730. It was established by the inventor on this principle, that there are primitive colors, of which all the rest may be composed by mixing them in various proportions; that any two of these colors being mixed together, preserve their original power, and only produce a third color, such as their compound must necessarily give; but if transparent colors be mixed, and three primitive kinds be compounded together, they destroy each other, and produce black, or a tendency to it, in proportion to the inequality or quality of the mixture; and that if, therefore, three colors be laid, either separately or upon each other, by three plates, engraved correspondently on these principles to the coloring of the design, the whole variety of teints necessary may be produced. The requisites, therefore, to the execution of any design in this method of printing, are as follows:—1. To settle a plan of the coloring to be imitated; showing where the presence of each of the three simple colors is necessary, either in its pure state, or combined with some other, to produce the effect required; and to reduce this plan to a painted sketch of each, in which not only the proper outlines, but the degree of strength, should be expressed. 2. To engrave three plates according to this plan, which may print each of the colors exactly in the places where, and proportion in which, they are wanted. 3. To find three transparent substances proper for printing with these three primitive colors.

The manner in which M. Le Blon prepared the plates was as follows:—The three plates of copper were first well fitted with respect to size and figure to each other, and grounded in the same manner as those designed for mezzotinto prints; and the exact place and boundary of each of the three primitive colors, conformably to the design were sketched out on three papers.

answering in dimensions to the plate. These sketches were then chalked on the plates; and all the parts of each plate, that were not to convey the color to which it was appropriated to the print, were entirely scraped away, as in forming the light of mezzotinto prints. The parts that were to convey the colors were then worked upon; and, where the most light or diluted teints of the color were to be, the grain in the ground was proportionably taken off; but where the full color was required it was left entire. In this regard was had, not only to the effects of the color in its simple state, but to its combined operation, either in producing orange-color, green, or purple, by its admixture with one alone; and likewise to its forming brown, gray, and shades of different degrees, by its co-operation with both the others. But, though the greatest part of the engraving was performed in the mezzotinto manner, yet the graver was employed occasionally for strengthening the shades, and for correcting the outline, where it required great accuracy and steadiness. It was necessary sometimes to have two separate plates for printing the same color, in order to produce a stronger effect; but the second plate, which was used to print upon the first, was intended only to glaze and soften the colors in particular parts that might require it. As to the black and brown teints, which could not be so conveniently produced in a due degree by the mixture of the colors, umber and black were likewise used. As to the order in which the plates are to be applied, the color which is least apparent in the picture should be laid on first, that which is betwixt the most and least apparent next, and that which predominates last; except where there may be occasion for two plates for the same color, or where there is any required for adding browns and shades. M. Le Blon applied this art to portraits, and showed, by the specimens he produced, the possibility of its being brought, by farther improvements, to afford imitations of painting which might have some value. It is nevertheless much better adapted to the simpler subjects, where there are fewer intermixtures of colors; and where the accuracy of the reflections, and demi-teints, are not so essentially necessary to the truth of the design, from the greater latitude of the form and disposition of the color, as in plants, anatomical figures, and some subjects of architecture. But perhaps plates engraved, or rather finished with the tool, particularly with respect to the outline, would be better accommodated in some of these cases than those prepared only by scraping. Mr. Cochin remarks, at the end of an account given of M. Le Blon's manner, that, though this ingenious artist confined his method principally to the use of three colors; yet, should this invention be again taken up and cultivated, there would be more probability of success in using a greater variety; and that several different kinds might be printed by one plate, provided they were laid on in their proper places by printing-balls, which should be used for that color only. His hint might, however, be very greatly improved, by the further assistance of pencils, accommodated to the plates, for laying on the colors in the proper parts.

The art of mezzotinto engraving was at first considered as only adapted to broad subjects; and, where high minute finishing was required, it was thought vain to attempt it; but the great advance made since the introduction of the art has convinced every artist and amateur to the contrary; and the successful works of Eadom (especially his masterly flower-pieces) are admirable specimens of its power, as also are the beautiful productions of Hodges, Dixon, and many other artists of the present day. It is decidedly most appropriate for the engraving of portraits, both as to touch and effect. The art of scraping mezzotinto has been applied to the printing with a variety of colors, in order to produce the resemblance of paintings.

MEZZOVO, a considerable trading town of Albania, Greece. It is an inland place, and about twenty-two miles north by east of Joannina. Inhabitants (descendants of a colony of Bulgarians) about 7500.

MIAMI, a country of the United States, in the south-west part of Ohio, North America; watered by the Miami Rivers, including the countries of Champaign, Clinton, Clermont, Green, Hamilton, Warren, Butler, Preble Montgomery, Miami, and Dark.—It is the name also of three inconsiderable townships of the Ohio state.

MIAMI, a county of the United States, in Ohio. Troy is the chief town.

MIAMI BAY, a bay on the south-west shore of Lake Erie, in North America, at the mouth of the Miami of the Lakes. It is about eighteen miles in circumference. It affords good anchorage and shelter.

MIAMI, GREAT, a river of the United States, in Ohio, which has its rise in the Indian country, between lat. 40° and 41° N. from two branches. The united streams flow south and south-west, and enter the Ohio in lat. 39° 4′ N. twenty miles below Cincinnati. It interlocks with the head branches of the Wabash; and with those of the Miami of the Lakes and the Scioto. Its entire length is 130 miles: it is 200 yards wide at its mouth; and flows through a wide and fertile valley, liable to partial inundation. It is navigable for boats seventy-five miles.

MIAMI, LITTLE, has its source in Green county, in the state of Ohio, and falls into the river Ohio, six miles above Cincinnati. Its length in a direct line is not more than sixty miles, but twice that distance if its windings are taken into the account. It is 150 yards wide at its mouth during high water, and its course is nearly parallel with the Great Miami, being nowhere more than twenty miles distant. The channel is precipitous, affording an immense number of mill-seats. Several paper-mills are already established on its banks.

MIAMI OF THE LAKES, a river of the United States, which rises in Indiana, and is formed by the St. Joseph's and St. Mary's, and running E.N.E. through the north-west part of the Ohio state. It flows into Miami Bay, at the west end of Lake Erie. It is navigable to Fort Wayne 120 miles, interrupted only by the rapids above Fort Meigs, which are fifteen miles long, and commence eighteen miles from its mouth.

MI'ASM, *n. s.* } Gr. μιαινω, to daub, or in-
MIAS'MA, } fect. Impurity, real or supposed, in the air, such as to communicate infection or disease.

The plague is a malignant fever, caused through pestilential *miasms* insinuating into the humoral and consistent parts of the body.

Harvey on Consumptions.

The variety of effects induced by different impurities of the air renders it absolutely necessary to discriminate them with as much accuracy as possible. We shall, therefore, confine the term *miasma* to its original meaning, as used by Hippocrates, and, as all the rest have appropriate terms, we shall defer them to the articles in their order. *Dr. A. Rees.*

MIAVA, a town of Hungary on the Miava River, which joins the Morava. It contains 10,000 inhabitants, chiefly Lutherans, and some manufactures of woollen and linen, considerable distilleries. Population (of Sclavonian origin) 10,000. Forty-five miles N. N. E. of Presburg, and sixty-three north-east of Vienna.

MICAH, the seventh of the twelve minor prophets. He is cited by Jeremiah, and prophesied in the days of Jotham, Ahaz, and Hezekiah. He censures the reigning vices of Jerusalem and Samaria, and denounces the judgment of God against both kingdoms. He also foretels the confusion of the enemies of the Jews, the coming of the Messiah, and the glorious success of the church.

MICAH, or THE BOOK OF MICAH, a canonical book of the Old Testament, written by the prophet Micah.

MICAIAH, the son of Imlah, an Ephraimite, a faithful prophet of Israel, under Ahab, who predicted the death of that monarch. See 1 Kings, xxii. 8—28, and AHAB.

MICHAEL, or MICHEL, i. e. who is like to God? The scripture account of Michael is, that he was an archangel, who presided over the Jewish nation, as other angels did over the Gentile world, as is evident of the kingdoms of Persia and Greece (Dan. x. 13); that he had an army of angels under his command (Rev. xii. 7); that he fought with the dragon, or Satan, and his angels; and that, contending with the Devil, he disputed about the body of Moses (Jude 9). As to the combat between Michael and the Dragon, some authors understand it literally. Others take it in a figurative sense: and refer it either to the contest that happened at Rome between St. Peter and Simon Magus, in which the apostle prevailed over the magician, or to those violent persecutions under which the church labored for 300 years. The Romish church celebrates three appearances of Michael, which happened, they say, long after the age of the apostles: viz. 1. At Colossæ in Phrygia, but when is uncertain. 2. At Mount Garganus, in Naples, about the end of the fifth century. 3. His appearance to Aubert bishop of Avranches, A. D. 706, upon a rock called the Tomb, where the abbey of St. Michael stands. The first of these festivals is observed on the 6th of September, the second on the 8th of May, and the last on the 16th of October. It has been supposed that it was Michael who conducted the Israelites in their journey through the wilderness (see Exod. xxxii. 34. and xxxiii. 2); who appeared to Moses in the burning bush, to Joshua in the fields of Jericho, and to Gideon and Manoah the father of Sampson. In a word, to him have been imputed the greatest part of the most remarkable appearances in the Old and New Testament. Bishop Horsely, in his remarkable sermon on Dan. iv 17, labors to prove that Michael the archangel is the Redeemer.

MICHAEL, MOUNT, one of the most celebrated state prisons of France, lies about twenty miles from Granville. It is a rock situated in the middle of the bay of Avranches; and is only accessible at low water. One side is naturally completely fortified by its craggy and almost perpendicular descent, which renders it impracticable to climb it by any address or courage, however consummate. The other parts are surrounded by walls fenced with semilunar towers after the Gothic manner, but sufficiently strong, together with the advantage of its situation, to render it impregnable to any attack. At the foot of the mountain begins a street or town, which winds round its base to a considerable height. Above are chambers where state-prisoners were kept, and where there are other buildings intended for residence. On the summit is erected the abbey itself, occupying a prodigious space of ground; and of a strength and solidity equal to its enormous size; as it has for many centuries withstood all the injuries of the weather, to which it is so much exposed. In an apartment, called the Sale de Chevalerie, the knights of St. Michael used to meet in solemn convocation, on important occasions. They were the defenders and guardians of this mountain and abbey, as those of the temple, and of St. John of Jerusalem, were of the holy sepulchre.

MICHAEL (St.,) or ST. MICHAEL'S, a borough of Cornwall, between St. Columb and Truro, 247 miles from London. Though one of the oldest boroughs in the county by prescription, it is now a mean hamlet in the parishes of Newland and St. Enidore; yet it is governed by a portreeve, chosen annually by a jury of the chief inhabitants, out of the six chief tenants, called deputy lords of the manor, because they hold lands in the borough. It has two fairs, and a court-leet is held twice a-year. It was formerly called Modishole.

MICHAEL (St.), GULF OF, a bay of South America, on the south-east side of the Gulf of Panama, and formed by the mouths of the rivers Congo, Santa Maria, &c. It has several islands which form a very good shelter for a large fleet, and its sides are surrounded with mangroves.

MICHAELIS (John David), a celebrated biblical critic, and author of many esteemed works, was the eldest son of a professor in the university of Halle in Lower Saxony, and was born there, February 27th 1717 He received the first part of his education in a celebrated Prussian seminary, called the Orphan-house, at Glauche, near Halle. He commenced his academical career at Halle in 1733, and took his degrees of A. M. and of philosophy in 1739. In 1741 he came to England, where his knowledge of the oriental languages, which was increased by his indefatigable researches in the

Bodleian library at Oxford, introduced him to the acquaintance and esteem of our first literary characters; with several of whom, particularly bishop Lowth, he corresponded for many years. He returned to Halle in fifteen months, and began to read lectures on the historical books of the Old Testament, which he continued after his removal to Gottingen in 1754. In 1746 he was appointed professor extraordinary, and soon after of philosophy. In 1747 he was appointed secretary to the Royal Society there, of which he was director in 1761, and was soon after made Aulic counsellor by the court of Hanover. In 1764 a publication relative to a journey to Arabia, which was undertaken by several literary men, at the expense of the king of Denmark, procured him the honor of being chosen a member of the Academy of Inscriptions at Paris, of whom the institution admitted only eight; and in the same year he became a member of the society at Haerlem. In 1775 count Hopkin, who eighteen years before had prohibited the use of his writings at Upsal, when chancellor of that university, prevailed upon the king of Sweden to confer on him the order of the polar star, as a national compensation. In 1768 he was appointed a privy counsellor of justice by the court of Hanover; and in 1788 received his last literary honor, by being elected F. R. S. of London. His great critical knowledge of the Hebrew, which he displayed in a new translation of the Bible, and in other works, raised him to a degree of eminence almost unknown before in Germany; and his labors were indefatigable in instructing the numerous students of all countries who attended his admirable lectures, which he continued to deliver on the sacred writings in half yearly courses, and on the Hebrew, Arabic, and Syriac languages, to the last year of his life. He was professor in the university of Gottingen forty-five years, and died October 22d, 1791, aged seventy-four. He left behind him several valuable MSS.

MIC'HAELMAS, *n. s.* Michael and mass. The feast of the archangel Michael, celebrated on the 29th of September.

They compounded to furnish ten oxen after *Michaelmas* for thirty pounds price. *Carew.*

MICHAELOVKA, a town in the government of Kursk, European Russia, on the Svapa. It has manufactures of leather, hemp, seed, oil, and wax; and trades in wood, corn, and hemp. Population 6000. Sixty-two miles W. N. W. of Kursk.

MICHE, *v. n.* } Sax. mæcꞇan; Teut. *mau-*
MICH'ER, *n. s.* } *chen,* to conceal. To lie hid or neglected: mich and mick are still used provincially for an idle, or small (easily concealed) person: a micher is used below for a loiterer.

How tenderly, her tender hands between,
In ivory cage she did the *micher* bind. *Sidney.*

Marry this is *miching* malicho; it means mischief. *Shakspeare.*

Shall the blessed son of heaven prove a *micher*, and eat blackberries? a question not to be asked. Shall the son of England prove a thief, and take purses? a question to be asked. *Id.*

MICHIGAN LAKE, a lake of North America, belonging to the United States, is 262 miles in length, and fifty-five in breadth, containing, according to Hutchings, 10,368,000 acres. It has a depth of water sufficient for vessels of any size, and has a communication with Lake Huron, by the river or channel of Michillimackinack. The waters of this, as well as of the other great lakes, are clear and wholesome, and contain abundance of fish. Its banks are fertile, and in the north-west are two excellent bays, i. e. Noquet's and Green's.

MICHIGAN TERRITORY, a territory of the United States, is a large peninsula, bounded on the north by the straits of Michillimackinack; on the north-east by Lake Huron; on the east by St. Clair's River and Lake, by Detroit River, and Lake Erie; on the south by Ohio and Indiana; and on the west by Lake Michigan. Long. 82° 7′ to 85° 20′ W., lat. 41° 45′ to 45° 34′ N.; two hundred and fifty miles long, from north to south, and one hundred and fifty miles broad; and containing about thirty thousand square miles.

The territory is divided into 18 counties, 14 of which lie to the east, and 4 to the west of Lake Michigan. They are,

Berrien	Monroc	Wayne	
Cass	Oakland	Detroit, City	
Jackson	St. Clair	Brown	West
Lenamee	St. Joseph	Chippewa	of Lake
Macomb	Van Buren	Crawford	Michi-
Michillimackinac	Washtenaw	Towa	gan.

The chief towns are Detroit, Niles, Edwardsbury, and Mackinac, and the population of the territory amounts to 31,260 inhabitants, few of whom are in slavery.

The rivers of this territory are numerous, and mostly navigable for boats to their sources. Those flowing into Lake Michigan are St. Joseph's, Black, Marame, Barbice, Raisin, Grand, Mastigon, White, Rocky, Beauvais, St. Nicholas, Marguerite, Monistic, Aux Sables, and Grand Traverse. Saganaum River flows in Saganaum Bay in Lake Huron.

There are no mountains in this territory; the interior is table land, having a northern and western inclination, interspersed with small lakes and marshes, from which issue the head branches of the river. There are prairies, from the banks of St. Joseph's to Lake St. Clair; some of an excellent soil, others sandy, wet, and sterile. There are also extensive forests of lofty timber, consisting of oak, sugar maple, beach, ash, poplar, white and yellow pine, cucumber, buckeye, bass-wood, hickory, cedar, plum, crab apple, cherry, black and honey locust. The timbered lands are well adapted to the production of most kinds of grain. There is no part of the United States more abundantly supplied with fish, aquatic fowls, and wild game.

The climate generally is accounted healthy. In the southern part it resembles that of the west part of New York and Pennsylvania. In the northern part it is more severe.

MICHILLIMACKINACK, a broad river or strait, by which Lake Huron communicates with that of Michigan. It is six miles wide, and from twenty to thirty long.

MICHILLIMACKINACK, or MACKINACK, an island and fort, situated in the above straits. The island is of an elliptical form, full of wood, and about seven miles in circumference, rising towards the centre, its figure suggesting to the Aborigines the appropriate name of Michi Mackina, or Great Turtle. The fort stands on a rising ground, 150 feet above the waters of the lake, 100 from its shores. It is a strong stockade, neatly built, and exhibits a fine appearance from the water. A village near the fort contains a Roman Catholic church, and 100 or 150 small houses. It is considerably resorted to by all the north-west traders. The climate is severe. 200 miles N.N.W. of Detroit.

MIC'KLE, *adj.* Sax. micel; Goth. and Swed. *mickel;* Scot. *muckle.* Much; great. See MUCH.

This reade is rife that oftentime
Great cumbers fall unsoft:
In humble dales is footing fast,
The trode is not so tickle,
And, though one fall through heedless haste,
Yet is his miss not *mickle*. *Spenser's Pastorals.*

O, *mickle* is the powerful grace, that lies
In plants, herbs, stones, and their true qualities.
Shakspeare.

Many a little makes a *mickle*. *Camden's Remains.*

All this tract that fronts the falling sun,
A noble peer, of *mickle* trust and power,
Has in his charge. *Milton.*

MICKLE (William Julius), the celebrated translator of the Lusiad, was born about 1735, and was educated by his father. After the death of his father he came to Edinburgh to reside with an uncle who was a brewer there, and who admitted him into a share of his business; but disliking the trade he went to London about 1761, with a view to procure a commission in the marine service. The first of his poems which appeared in print was published in one of the Edinburgh magazines, and entitled On passing through the Parliament Close of Edinburgh at Midnight. In 1756 he published the poem which first brought him into notice, entitled Pollio, an Elegiac Ode, written in the wood near R—— (Roslin) Castle, 4to. This was an elegy on the death of his brother, which, previously to its publication, had been shown to lord Lyttleton, and received some corrections from him. The latter, in an epistle to the author, spoke of it as equal to any thing of the kind in our language. In 1767 he published a poem called The Concubine, in two Cantos, after the manner of Spenser, 4to.; and in 1769 a Letter to Mr. Harwood, wherein some of his evasive Glosses, false Translations, and blundering criticisms, in support of the Arian heresy, contained in his Literal Translation of the New Testament, are pointed out and confuted, 8vo. In 1770 he published Mary Queen of Scots, an elegy; Hengist and Mary, a ballad; and Knowledge, an ode; in Pearche's Collection of Poems: also Voltaire in the Shades, or Dialogues on the Deistical Controversy, 8vo. About this time Mr. Mickle was a frequent writer in the Whitehall Evening Post; but a more important work now engaged his attention. This was the translation of the Lusiad of Camoens into the English Language, and which he completed in 1775. A second edition was prepared in 1778, with a plate prefixed to it, executed by Mortimer; on whom Mr. Mickle wrote an epitaph in 1779. This year also he published a pamphlet, entitled A Candid Examination of the Reasons for depriving the East India Company of its Charter. Bishop Lowth would have provided for him in the church, but this was not agreeable to our author's disposition; and he was soon after appointed secretary to commodore Johnstone, who had obtained the command of the Romney man of war. In 1771 he arrrived at Lisbon, and was named by his patron joint agent for the prizes which were taken. In this capital he resided above six months, and during this period he wrote his poem, entitled Almada Hill, which in 1781 was published in 4to. In 1782 he published the Prophecy of Queen Emma, an ancient ballad lately discovered, written by Johannes Turgottus, prior of Durham, in the reign of William Rufus; to which is added by the Editor, an Account of the Discovery, and hints towards a vindication of the Authenticity of the Poems of Ossian and Rowley, 8vo. In June 1782 he married Miss Tomkins, daughter of Mr. Tomkins of Forest-hill. Having received some fortune with this lady, and having saved some money himself when in the service of commodore Johnstone, he now enjoyed a comfortable independence. Having fixed his residence at Wheatley, in Oxfordshire, the last seven years of his life were employed in writing for the European Magazine. The fragments of Leo, and some of the most approved reviews of books, in that work were of his production. He died on the 25th of October 1788 at Wheatley, leaving one son.

MI'CROCOSM, *n. s.* From Gr. μικρος, little, and κοσμος, world. The little world: a term often metaphorically applied to man.

You see this in the map of my *microcosm*.
Shakspeare.

She to whom this world must itself refer,
As suburbs, or the *microcosm* of her;
She, she is dead; she's dead, when thou knowest this,
Thou knowest how lame a creeple this world is.
Donne.

How doth the head of this *microcosm* resemble that round celestial globe. *Bp. Hall.*

As in this our *microcosm*, the heart,
Heat, spirit, motion, gives to every part.
So Rome's victorious influence did disperse
All her own virtues through the universe.
Denham.

Philosophers say that man is a *microcosm*, or little world, resembling in miniature every part of the great; and the body natural may be compared to the body politick. *Swift.*

MICROCOSMIC SALTS. A triple salt of soda, ammonia, and phosphoric acid, obtained from urine, and much used in assays by the blowpipe. This compound is best procured by mixing equal parts of the phosphate of soda and phosphate of ammonia in solution, and then crystallising. A faint excess of ammonia is useful in the solution.

MICROG'RAPHY, *n. s.*
MICROM'ETER,
MI'CROSCOPE
MICROSCOP'IC, *adj.*
MICROSCOP'ICAL.
} Of μικρος, little, and γραφω, to describe; μετρον, a measure, and σκοπεω, to inspect.

Micrography is the description of small, or microscopic, objects: micrometer, an instrument for measuring small spaces or distances, particularly in the heavens: microscope, an optical instrument for magnifying small, and otherwise invisible, bodies. See the scientific description of both these important instruments.

The honey bag is the stomach, which they always fill to satisfy and to spare, vomiting up the greater part of the honey to be kept against winter; a curious description and figure of the sting see in Mr. Hook's *micrography*. *Grew's Museum.*

If the eye were so acute as to rival the finest *microscopes*, and to discern the smallest hair upon the leg of a gnat, it would be a curse, and not a blessing to us; it would make all things appear rugged and deformed; the most finely polished crystal would be uneven and rough; the sight of our own selves would affright us; the smoothest skin would be beset all over with ragged scales and bristly hairs. *Bentley.*

Make *microscopical* observations of the figure and bulk of the constituent parts of all fluids.

Arbuthnot and Pope.

The critick eye, that *microscope* of wit,
Sees hairs and pores, examines bit by bit.

Dunciad.

Why has not man a *microscopic* eye?
For this plain reason, Man is not a fly:
Say what the use, were finer opticks given,
T' inspect a mite, not comprehend the heaven?

Pope.

Evading even the *microscopic* eye!
Full nature swarms with life.

Thomson's Summer.

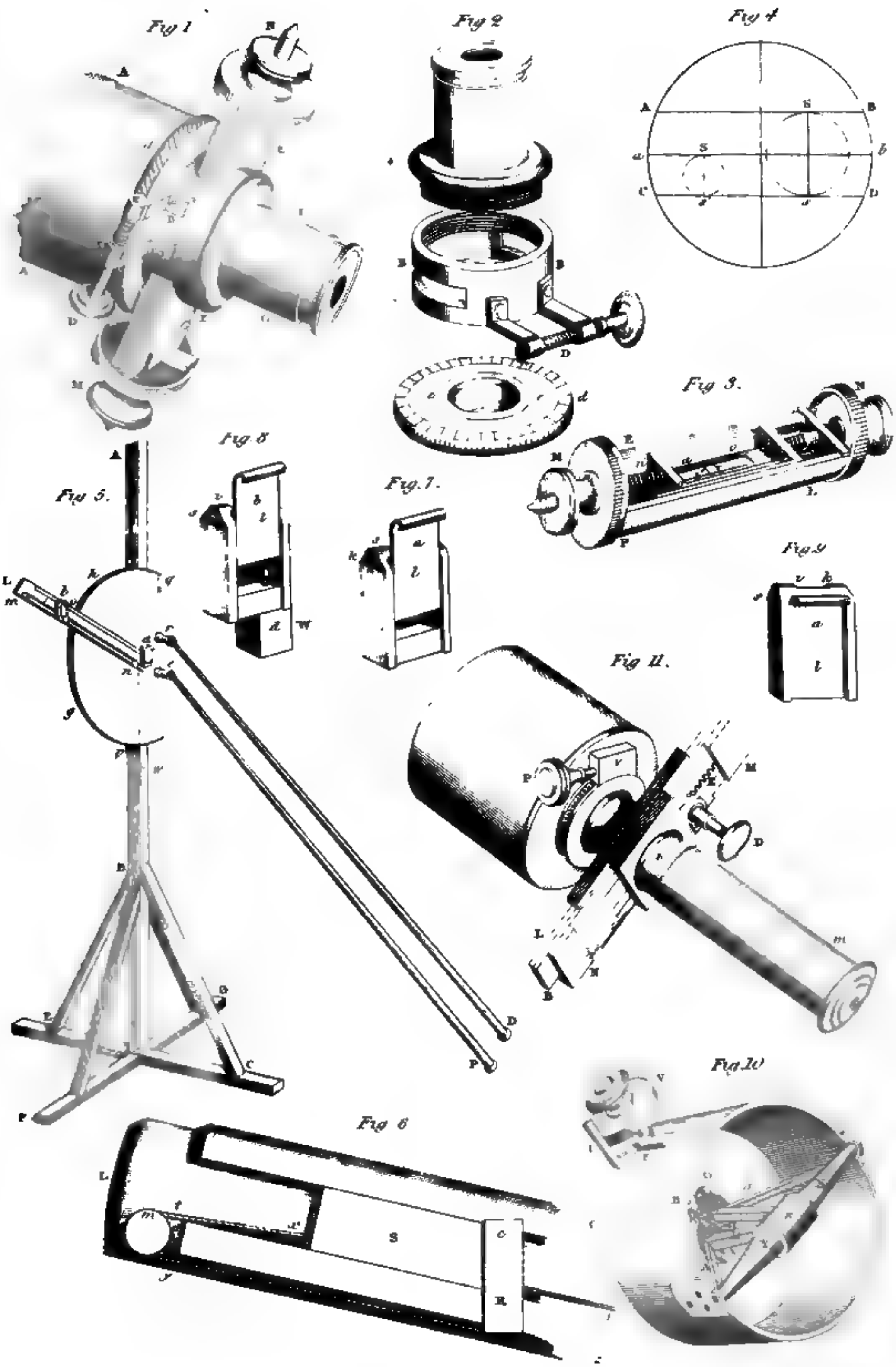
MICROMETER. The telescope and microscope both owe their most important applications to the use of this instrument. To the modern introduction of the micrometer for the use of the astronomer, and the improvement of the telescope, may indeed be attributed our accurate and extensive acquaintance with the universe of matter; while, from the perfection to which the microscope has recently been brought, an equal acquaintance with the minute organisation of bodies may be expected. By the application of the micrometer to this latter instrument the power of the naturalist is materially extended; while the micrometer is of the utmost value for trigonometrical surveys, and in military or naval operations.

M. de la Hire, in a discourse on the era of the inventions of the micrometer, pendulum clock, and telescope, before the Royal Academy of Sciences, makes M. Huygens the inventor of this instrument. 'That author,' he observes in his observations on Saturn's ring, &c., published 1659, 'gives a method of finding the diameters of the planets by means of a telescope, viz. by putting an object which he calls a virgula, of a size proper to take in the distance to be measured, in the focus of the convex object-glass; in this case, says he, the smallest object will be seen very distinctly in that place of the glass. By such means, he adds, he measured the diameter of the planets, as he there delivers them.' 'This micrometer,' continues the same ingenious author, 'is so very little different from that published by the marquis de Malvasia, in his Ephemerides, three years after, that they ought to be esteemed the same; and the micrometer of the marquis differed yet less from that published four years after his, by Azout and Picard. Hence de la Hire concludes 'that it is to Huygens the world is indebted for the invention of the micrometer, without taking any notice of the claim of our countryman Gascoigne, which, however, is many years prior to any of them.'

We may now, however, proceed to a more minute examination of this instrument, commencing with its simplest form.

The *wire micrometer* is an instrument fitted to the eye-piece of a telescope, for the purpose of measuring the angles subtended by small spaces in the heavens, such as the diameters of the planets, &c., by comprehending these spaces between two delicate parallel fibres, which retain their parallelism while they are opened and shut by a mechanical contrivance. This instrument is represented in plate I. MICROMETER, figs. 1 and 2, as attached, along with the eye-piece G F, to the tube of the telescope A A, by means of a screw round the circumference of the circular plate *d*, figs. 1 and 2. Within this circular plate is fixed a conical ring *e e*, fig. 2, fastened to a second ring B B, by three small screws, the ends of which may be seen in fig. 2. By turning the screw D, therefore, which works in teeth cut upon the circumference *d*, the whole eye-piece, along with the micrometer M N, may be made to revolve upon the conical ring *e e* as a centre. The inclination of the micrometer to the horizon is pointed out upon the flat surface of the ring *d*, which is divided into 360°, &c. Into the ring B B is screwed the common Huygenian eye-piece F G. The micrometer itself is contained in the box E E, figs. 1 and 3, which moves freely through the square holes in the ring B B, that the observer may follow an object while it is passing quickly through the field of the telescope. To show the interior construction of the instrument we have represented it, in fig. 3, with one of the sides removed. The fork of brass *n n* is fixed to the largest of the two small screws on the right hand side of the figure, and on the other end of the screw is placed a nut, L, united to the divided head N, and moving, with its female screw, upon the male screw already mentioned. By turning the nut L the fork *n n* may be moved backwards and forwards in the directions N M, M N, without any lateral shake. Within the fork *n n* is placed a second fork *o o*, fixed to another male screw on the left hand side of the figure, which may in like manner be moved backwards and forwards by means of the nut M, fixed to the divided head P. Across the lower side of each fork is extended a delicate fibre, or silver-wire, *e e*, which partakes of the motion of the fork to which it belongs, and both these fibres are so fixed that they always continue parallel, whatever be the distance to which they are separated by the motion of the forks. The lower sides of the forks are made in such a manner that the wires can just pass each other without touching; and at the instant of their passage they must coincide so completely as to appear one wire. When this takes place, the index should point to the zero of the scale *a* within the micrometer, each division of which is equal to the interval between any of

MICROMETERS.



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the threads of the male screw, and is of course passed over by either of the wires, during one complete revolution of the nut L or M. The graduated heads N and P are each divided into 100 parts, so that the distance between the wires can at any time be ascertained to the $\frac{1}{100}$th part of one of the divisions of the scale *a*. These divisions are generally the fiftieth of an inch each, so that every unit on the graduated head corresponds to the $\frac{1}{5000}$th part of an inch. A third wire *b*, lying in the direction of the screws, bisects the other two wires at right angles, and is intended to point out the direction in which the angle is to be measured. The angle subtended by the wires, when separated to any distance, is found by counting the number of revolutions, and parts of a revolution, of the divided head N or M, which are necessary to make the one wire move up to the other, and coincide with it. The number of seconds passed over by any of the wires, during one revolution of the head N or M, must be ascertained by actual experiment, that is, by measuring a base, and observing the space comprehended between the wires at the end of that base, where they are separated by so many revolutions; or by observing the time employed by an equatorial star in passing from the one wire to the other. When the angle is thus determined which corresponds to any given number of revolutions it may be found by simple proportion for any other number of revolutions; and these results may be conveniently put down in the form of a table, to prevent the necessity of future calculation.

Let it be required, for example, to measure the sun's diameter, and let us suppose that two revolutions of the divided head separate the wires to such a distance that they subtend exactly an angle of sixty seconds. Having directed the telescope to the sun, turn round the micrometer by means of the screw D, till the lower limb of the sun S *s*, fig. 4, just passes along the lowest parallel wire C D. Then turn the nut which moves the other wire A B, till it is at such a distance from C D that the upper limb of the sun just passes along it. The sun S *s* is now comprehended exactly between the wires, and the angle which they subtend is, therefore, a measure of his diameter. Let the wire A B be now moved towards C D till they coincide, and suppose that it requires sixty revolutions of the divided head, and $\frac{45}{100}$ths of a revolution, to produce this coincidence. Then, since two revolutions are equal to sixty seconds, 60·45 revolutions will be equal to 30·235′, or 30′ 13·5″, the diameter of the sun required. The diameter thus measured is obviously perpendicular to the direction of the sun's motion; but, when we wish to measure the diameter which is parallel to the line of his daily motion, we must guide his upper or his lower limb along the wire which bisects the parallel wires, and then separate the wires till the one extremity of the diameter is in contact with the first wire, at the very instant that the other extremity is in contact with the second wire. The motion of the sun, however, renders this observation so extremely difficult, that it is almost impossible to make it with any degree of accuracy.

By attending to the principles upon which this instrument is constructed, it will be easy to discover the numerous sources of error to which it is liable. The difficulty of finding the real zero of the scale, or the instant when the two wires appear to be in contact; the error arising from the want of parallelism in the wires, or from a lateral shake in the forks which carry them; the inflexion of light which takes place when the wires are near each other; the complicated structure of the instrument; the minuteness of the scale and all its parts; but especially the difficulty of procuring screws in which the distance of the thread is always the same, are objections inseparable from the construction of this instrument.

The *lamp micrometer*, contrived by the late Sir William Herschel, appears well calculated for its intended purpose, and is described by the inventor in vol. lxxii. of the Transactions of the Royal Society. A B G C F E, fig. 5, is a stand nine feet high, upon which a semi-circular board *q h o g p* is moveable upwards or downwards, in the manner of some fire-screens, as occasion may require, and is held in its situation by a peg *p*, put into any one of the holes of the upright piece A B. This board is a segment of a circle of fourteen inches radius, and is about three inches broader than a semi-circle, to give room for the handles, *r* D, *e* P, to work. The use of this board is to carry an arm L, thirty inches long, which is made to move upon a pivot at the centre of the circle, by means of a string, which passes in a groove upon the edge of the semi-circle *p g o h q*; the string is fastened to a hook at *o* (not expressed in the figure, being at the back of the arm L), and passing along the groove from *o h* to *q* is turned over a pulley at *q*, and goes down to a small barrel *e*, within the plane of the circular board, where a double-jointed handle *e* P commands its motion. By this contrivance we see the arm L may be lifted up to any altitude from the horizontal position to the perpendicular, or be suffered to descend by its own weight below the horizontal to the reverse perpendicular situation. The weight of the handle P is sufficient to keep the arm in any given position; but, if the motion should be too easy, a friction-spring applied to the barrel will moderate it at pleasure.

In front of the arm L a small slider, about three inches long, is moveable in a rabbet from the end L towards the centre backwards and forwards. A string is fastened to the left side of the little slider, and goes towards L, where it passes round a pulley at *m*, and returns under the arm from *m*, *n*, towards the centre, where it is led in a groove on the edge of the arm, which is of a circular form, upwards to a barrel (raised above the plane of the circular board) at *r*, to which the handle *r* D is fastened. A second string is fastened to the slider, at the right side, and goes towards the centre, where it passes over a pulley *n*, and the weight *w*, which is suspended by the end of this string returns the slider towards the centre, when a contrary turn of the handle permits it to act.

a and *b* are two small lamps, two inches high, one and a half in breadth by one and a quarter

in depth. The sides, back, and top, are made so as to permit no light to be seen, and the front consists of a thin brass folding-door. The flame in the lamp *a* is placed three-tenths of an inch from the left side, three-tenths from the front, and half an inch from the bottom. In the lamp *b* it is placed at the same height and distance measuring from the right side. The wick of the flame consists only of a single very thin lamp-cotton thread; for, the smallest flame being sufficient, it is easier to keep it burning in so confined a place. In the top of each lamp must be a little slit, lengthways, and also a small opening in one side near the upper part, to permit air enough to circulate to feed the flame. To prevent every reflexion of light, the side opening of the lamp *a* should be to the right, and that of the lamp *b* to the left. In the sliding door of each lamp is made a small hole with the point of a very fine needle, just opposite the place where the wicks are burning, so that when the sliders are cut down, and every thing dark, nothing shall be seen but two fine lucid points of the size of the two stars of the third or fourth magnitude. The lamp *a* is placed so that its lucid point may be in the centre of the circular board, where it remains fixed. The lamp *b* is hung to the little slider which moves in the rabbet of the arm, so that its lucid point, in a horizontal position of the arm, may be on a level with the lucid point in the centre. The moveable lamp is suspended upon a piece of brass fastened to the slider by a pin exactly behind the flame, upon which it moves as a pivot. The lamp is balanced at the bottom by a leaden weight, so as always to remain upright, when the arm is either lifted above, or depressed below, the horizontal position. The double-jointed handles *r* D, *e* P, consist of light deal rods ten feet long, and the lowest of them may have divisions marked upon it near the end P, expressing exactly the distance from the central lucid point in feet, inches, and tenths.

From this construction we see that a person at a distance of ten feet may govern the two lucid points, so as to bring them into any required position south or north, preceding or following, from 0° to 90°, by using the handle P, and also to any distance, from six-tenths of an inch to five or six-and-twenty inches, by means of the handle D. If any reflexion or appearance of light should be left from the top or sides of the lamps, a temporary screen, consisting of a long piece of pasteboard, or a wire frame covered with black cloth, of the length of the whole arm and of any required breadth, with a slit of half an inch broad in the middle, may be affixed to the arm by four bent wires projecting an inch or two before the lamps, situated so that the moveable lucid point may pass along the opening left for that purpose.

Fig. 6 represents part of the arm L, half the real size; S the slider; *m* the pulley, over which the cord *x t y z* is returned towards the centre; *v* the other cord going to the pulley *n* of fig. 5; R the brass-piece moveable upon the pin *c*, to keep the lamp upright. At R is a wire riveted to the brass piece, upon which is held the lamp by a nut and screw. Figs. 7 and 8 represent the lamps *a*, *b*, with the sliding doors open, to show the situation of the wicks. W is the leaden weight with a hole *d* in it through which the wire R of fig. 6 is to be passed when the lamp is to be fastened to the slider S. Fig. 9 represents the lamp *a* with the sliding door shut, *l* the lucid point, and *i k* the openings at the top, and *s* at the sides for the admission of air.

Every ingenious artist will soon perceive that the motions of this micrometer are capable of great improvement by the application of wheels and pinions, &c.; but as the principal object is only to be able to adjust the two lucid points to the required position and distance, and to keep them there for a few minutes, while the observer goes to measure their distance, it will not be necessary to say more on the subject.

We have now to show the application of this instrument. It is well known to opticians and others, who have been in the habit of using optical instruments, that we can with one eye look into a microscope or telescope, and see an object much magnified, while the naked eye may see a scale upon which the magnified picture is thrown. In this manner Sir William Herschel generally determined the power of his telescopes; and any one who has acquired a facility of taking such observations, will very seldom mistake so much as one in fifty, in determining the power of an instrument; and that degree of exactness is fully sufficient for the purpose.

The Newtonian form is admirably adapted to the use of this micrometer; for the observer stands always erect, and looks in a horizontal direction, notwithstanding the telescope should be elevated to the zenith. Besides, his face being turned away from the object to which his telescope is directed, this micrometer may be placed very conveniently without causing the least obstruction to the view. Sir W. Herschel observed that, when he used this instrument, he put it at ten feet distance from the left eye, in a line perpendicular to the tube of the telescope, and raised the moveable board to such a height that the lucid point of the central lamp may be upon a level with the eye. The handles lifted up, are passed through two loops fastened to the tube, just by the observer, so as to be ready for his use. It may be proper to state that the end of the tube is cut away so as to leave the left eye entirely free to see the whole micrometer.

Having now directed the telescope to a double star, view it with the right eye, and at the same time with the left see it projected upon the micrometer: then, by the handle P, which commands the position of the arm, raise or depress it so as to bring the two lucid points to a similar situation with the two bars; and, by the handle D, approach or remove the moveable lucid point to the same distance of the two stars, so that the two lucid points may be exactly covered by, or coincide with, the stars. A little practice in this business soon makes it easy, especially to one who has already been used to look with both eyes open.

What remains to be done is very simple. With a proper rule, divided into inches and fortieth parts, take the distance of the lucid points, which may be done to the greatest nicety,

because the little holes are made with the point of a very fine needle. The measure thus obtained is the tangent of the magnified angle under which the stars are seen to a radius of ten feet; therefore, the angle being found and divided by the power of the telescope gives the real angular distances of the centres of a double star.

The late Mr. Ramsden described two valuable micrometers, which he contrived with the view of remedying the defects of those that had been previously constructed. One of these is a catoptric micrometer, and can have no aberration, nor is it liable to any defect arising from the imperfection of the materials or execution; as the extreme simplicity of its construction requires no additional mirrors or glasses to those required for the telescope; and the separation of the image being effected by the inclination of the two specula, and not depending on the focus of any lens or mirror, any alteration in the eye of an observer cannot affect the angle measured. It has also the advantages of an adjustment, to make the images coincide in a direction perpendicular to that of their motion; and also of measuring the diameter of a planet on both sides of the zero, which is of no small advantage to observers, who know how much easier it is to ascertain the contact of the external edges of two images, than their perfect coincidence. A, fig. 10, represents the small speculum of a reflecting telescope, of Cassegrain's construction, to which this micrometer is adapted, divided into two equal parts; one of which is fixed on the end of the arm B; the other end of the arm is fixed on a steel axis X, which crosses the end of the telescope C. The other half of the mirror A is fixed on the arm D, which arm at the other end terminates in a socket *y*, that turns on the axis X; both arms are prevented from bending by the braces *a a*. G represents a double screw, having one part, *e*, cut into double the number of threads in an inch to that of the part *g*; the part *e* having 100 threads in one inch, and the part *g* fifty only. The screw *e* works in a nut F, in the side of the telescope, while the part *g* turns in a nut H, which is attached to the arm B; the ends of the arms B and D, to which the mirrors are fixed, are separated from each other by the point of the double screw pressing against the stud *h*, fixed to the arm D, and turning in the nut H on the arm B. The two arms, B and D, are pressed against the direction of the double screw *e g*, by a spiral spring within the part *n*, by which means all shake or play in the nut H, on which the measurement depends, is entirely prevented.

From the difference of the threads on the screw at *e* and *g*, it is evident that the progressive motion of the screw through the nut will be half the distance of the separation of the two halves of the mirror, and consequently the half mirrors will be moved equally in contrary directions from the axis of the telescope C.

The wheel V, fixed on the end of the double screw, has its circumference divided into 100 equal parts, and numbered at every fifth division, with 5·10, &c. to 100; and the index I shows the motion of the screw with the wheel round its axis, while the number of revolutions of the screw is shown by the divisions on the same index. The steel screw, R, may be turned by the key S, and serves to incline the small mirror at right angles to the direction of its motion.

The other micrometer, invented by Mr. Ramsden, is suited to the principle of refraction, and is thus described by Mr. Partington:—'This micrometer is applied to the erect eye-tube of a refracting telescope, and is placed in the conjugated focus of the first eye-glass; in which position, as the image is considerably magnified before it comes to the micrometer, any imperfection in its glass will be magnified only by the remaining eye-glasses, which in any telescope seldom exceeds five or six times; and besides, the size of the micrometer glass will not be the $\frac{1}{16}$th part of the area which would be required, if it were placed at the object-glass; and yet the same extent of scale is preserved, and the images are uniformly bright in every part of the field of the telescope. This micrometer is represented at fig. 11. A is a convex or concave lens, divided into two equal parts by a plane across its centre; one of these semi-lenses is fixed in a frame B, and the other in the frame E, which two frames slide on a plate H, and are pressed against it by thin plates *a a*; the frames B and E are moved in contrary directions by turning the button D; L is a scale of equal parts on the frame B; it is numbered from each end towards the middle with 12, 20, &c. There are two verniers on the frame E, one at M and the other at N, for the conveniency of measuring the diameter of a planet, &c., on both sides of the zero. The first division, on both these verniers, coincides at the same time with the two zeros on the scale L; and, if the frame is moved towards the right, the relative motion of the two frames is shown on the scale L, by the vernier M; but, if the frame B be moved towards the left, the relative motion is shown by the vernier N.

'This micrometer has a motion round the axis of vision, for the conveniency of measuring the diameter of a planet, &c., in any direction, by turning an endless screw F; and the inclination of the diameter measured with the horizon is shown on the circle *g*, by a vernier on the plate V. The telescope may be adjusted to distinct vision by means of an adjusting screw, which moves the whole eye-tube with the micrometer, nearer or farther from the object-glass, as telescopes are generally made; or the same effect may be produced in a better manner, without moving the micrometer, by sliding the part of the eye-tube *m* on the part *n*, by the help of a screw or pinion. The micrometer is made to take off occasionally from the eye-tube, that the telescope may be used without it.' Vide *Manual of Natural and Experimental Philosophy, by C. F. Partington.*

Mr. Cavallo has contrived a micrometer of very simple and easy construction. It consists of a thin and narrow slip of mother-of-pearl finely divided, and situated in the focus of the eye-glass of a telescope, just where the image of the object is formed. It is immaterial whether the telescope be a refractor or reflector, pro-

vided the eye-glass be a convex lens, and not a concave one as in the Galilean construction.

The simplest way of fixing it is to stick it upon the diaphragm, which generally stands within the tube, and in the focus of the eye-glass. When thus fixed, if you look through the eye-glass, the divisions of the micrometrical scale will appear very distinct, unless the diaphragm is not exactly in the focus; in which case the micrometrical scale must be placed exactly in the focus of the eye-glass, either by pushing the diaphragm backwards or forwards, when that is practicable; or else the scale may be easily removed from one or the other surface of the diaphragm by the interposition of a circular piece of paper or card, or by a bit of wax. This construction is fully sufficient when the telescope is always to be used by the same person; but, when the different persons are to use it, then the diaphragm, which supports the micrometer, must be constructed so as to be easily moved backwards or forwards, though that motion need not be greater than about a tenth or an eighth of an inch. This is necessary, because the distance of the focus of the same lens appears different to the eyes of different persons, and therefore, whoever is going to use the telescope for the measurement of any angle, must first of all unscrew the tube, which contains the eye-glass and micrometer, from the rest of the telescope, and, looking through the eye-glass, must place the micrometer where the divisions of it may appear quite distinct to his eye.

The mother-of-pearl micrometer may be applied to a microscope, and it will thus serve to measure the lineal dimensions of the object. The value of its divisions may be ascertained by placing an object of a known dimension before the microscope, and by observing how many divisions of the micrometer measure its magnified image. For instance, place a piece of paper, which is exactly one-tenth of an inch long, before the microscope; and, if it is found that fifty divisions of the micrometer measure its magnified image, the observer may conclude that each division denotes an extension of $\frac{1}{500}$th part of an inch in the object; for, if fifty divisions measure one-tenth, 500 divisions must measure the whole inch.

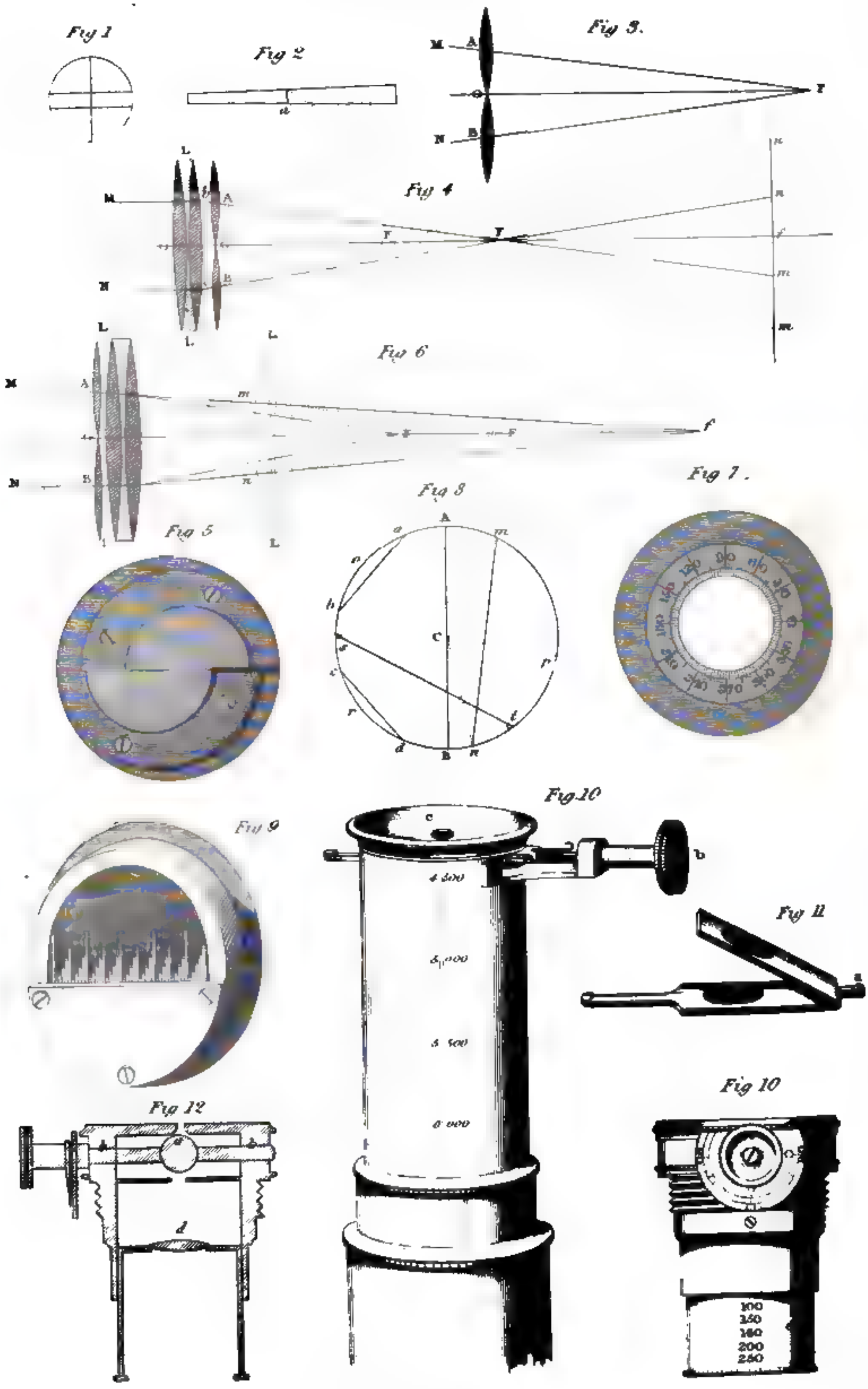
Mother-of-pearl was found by Cavallo, after many trials, to be a much more convenient substance than either glass, ivory, horn, or wood, as it is a very steady substance, the divisions are easily marked upon it, and, when made as thin as common writing-paper, it has a very useful degree of transparency.

Mr. Watt has furnished a description of several micrometers that he contrived, and of which he published an account in the Edinburgh Philosophical Journal. One was suggested about the year 1770, and was used in the surveys for the Crinan and Caledonian Canals.

The instrument he used was a telescope, with an object-glass of twelve inches, and an eye-glass of one inch and a half focus, consequently magnifying eight times. In the focus of the eye-glass there were placed two horizontal hairs, fig. 1. plate 2, and one perpendicular hair. The horizontal hairs were about one-tenth of an inch distant from each other, and as strictly parallel, and at right angles to the perpendicular as possible. A rod being placed upright at twenty chains distance, or any other convenient distance on level ground, an index, consisting of a round disc of about eight inches in diameter, painted white, with a horizontal line of one inch wide, painted on its horizontal diameter with vermilion, was fixed upon the rod about one foot from the ground, and another similar index was moved up and down the rod, until, upon looking through the telescope, the two horizontal hairs covered the red stripes on the lower and upper indexes, the telescope being turned on its axis until the perpendicular hair was parallel to the rod. The indexes being thus covered accurately by the horizontal hairs, the upper index was fixed to the rod, and the distance between the middle of the red stripes on the two indexes was divided upon the rod into twenty parts, representing so many chains, which, with the instrument Mr. Watt used, were upon the rod about four inches and a half each; and, for distances exceeding five chains, this division into equal parts was sufficiently accurate; but for shorter distances it is not strictly so. He therefore fixed a pin at every chain, and, holding up the rod at each of them, made the necessary correction; and, as the focus of the object-glass is also affected by the distance, it is proper to adjust the eye-glass to it at each station. The divisions on the rod being marked with the number of chains they represent, it was only necessary to send an assistant with the rod to any place the distance of which was wanted to be measured, and by signs to make him move the upper index up and down, until the two horizontal hairs covered the red stripes on the upper and lower indexes; the divisions on the rod then showed the distance, which could be ascertained to within less than $\frac{1}{100}$th part of the whole distance, and with a higher magnifying power could be done proportionally more accurate. The rod commonly used was twelve feet long, and consequently could measure thirty chains; but by sliding another rod upon it, so as to lengthen it, he measured greater distances; and, where still greater were wanted, a tape was stretched horizontally, and turning the telescope on its axis, made the single hair parallel to it, fixing one index at the end of the tape, and sliding the other along it subtended the distance between the wires. Mr. Watt then measured the subtended tape with the rod, and so ascertained the distance.

It is plain that this instrument possesses the advantage of measuring all distances with equal accuracy, until the imperfection of vision at great distances interposes, as the scale on which they are measured expands with the distances, and in uneven ground it possesses more accuracy than the chain, and is very valuable in measuring distances from one hill to another, and across bays of the sea, where the chain cannot be used.

Another micrometer, with a prism, Mr. Watt invented about that time; it consisted of a thin prism, with its surfaces nearly parallel, or inclined one degree or two as in fig. 2. This prism was



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cut by a diamond into two parts, which, when they were fixed in the same plane, refracted all the rays which passed through them equally; but one of them remaining fixed, and the other moving on a centre at *a*, according to the dotted line, would refract that portion of the rays which passed through it more than those which passed through the fixed part, and, being placed in the focus of the object-glass of a telescope, two images were formed of each object, by which its diameter could be measured. An index, and divided sector of a circle, served to measure the comparative refractions.

'The cross-hair micrometer, as described,' observes Mr. Watt, 'leaving me too much in the power of my assistants, where the distances were greater than permitted me to read off the number of chains on the rod myself, I thought of another about 1772, which consisted of a telescope with an object glass of a long focus, viz. three or four feet; this was placed in a tube with a slit in one side of it, nearly as long as the focus of the telescope, and the object-glass being fitted to a short tube, which slid from end to end of the slit, could be moved backwards and forwards by means of a piece of metal fixed to the short tube, and coming out through the slit; a glass of six to nine inches focus was all fixed in the outer tube, of the nature of what is called a field-glass, and to this was added an eye-glass, with a cross hair piece in its focus.

'Now it is evident that, if the object-glass be moved nearer the field-glass, their common focus will be shortened, and the image at the cross-hairs diminished proportionally, until the glasses come into contact, when their common focus will be shorter than that of the field-glass alone; and two indexes fixed upon a rod being subtended by the cross hair at any given distance, the same rod with its indexes being removed nearer the observer, upon sliding the object-glass nearer the eye, they may again be subtended by the cross-hairs, and a scale on the side of the tube will show the comparative distance they have been removed; and, the distance of the first object being known, that of the second will also be so. This scale could not, however, be a scale of equal parts, but one which could easily be laid down.'

The common divided object-glass micrometer consists of two semi-lenses A B, fig. 3, of the same focal length, formed by dividing a convex lens into two equal parts, by a plane which passes through its axis. The centres of these semi-lenses are made to separate and approach each other, by means of a screw or pinion along the line A B; and the distance of their centres is measured upon a scale subdivided by a vernier, or, as in the wire micrometers, by a graduated head fixed upon the screw.

If it be required to measure the angle subtended by two objects, M, N, the semi-lenses are separated till the two images of these objects are in contact, or till the image of M, formed by the semilens A, appears to be in contact with the image of N, formed by the semilens B. When this happens, the angle subtended by the objects is equal to the angle subtended by A B, the distance of the centres of the semilenses at the point F, or the focus of the lenses where the contact of the image takes place. It is manifest that an image of M will be formed in the line A F, and at F the focus of rays diverging from M. In like manner an image of N will be formed in the line B F, and at F the focus of rays proceeding from the radiant point N. Hence it is obvious that the angle subtended at F, by M N, is the same as the angle subtended by A B at F. The angle A F B may be easily found trigonometrically, the sides A B and O F being known; but, as this angle is generally very small, it may, without any perceptible error, be considered as proportional to the subtense A B, or the distance between the centres of the semilenses. By determining, therefore, experimentally, the angle which corresponds to any distance A B of the semilenses, we may by simple proportion find the angle for any other distance.

The new divided object glass micrometer contrived by Dr. Brewster consists of an achromatic object glass L L, fig. 4, having two semilenses A B, represented in fig. 5, moveable between it and its principal focus *f*. These semilenses are completely fixed, so that their centres are invariably at the same distance; but the angle subtended by the two images which they form is varied by giving them a motion along the axis O *f* of the lens L L. When the semilenses are close to L L the two images are much separated, and form a great angle; but, as the lenses are moved towards *f*, the centres of the images gradually approach each other, and the angle which they form is constantly increasing. By ascertaining, therefore, experimentally, the angle formed by the centres of the images, when the semilenses are placed close to L L, and also the angle which they subtend when the semilenses are at *f*, the other extremity of the scale, we have an instrument which will measure with the utmost accuracy all intermediate angles.

In constructing this micrometer, for astronomical purposes, the semilenses may be made to move only along a portion of the axis O *f*, particularly if the instrument be intended to measure the diameters of the sun and moon, or any series of angles within given limits. By increasing the focal length of the semilenses, or by diminishing the distance between the centres, the angles may be made to vary with any degree of slowness, and of course each unit of the scale will correspond to a very small portion of the whole angle. The accuracy and magnitude of the scale, indeed, may be increased without limit; but it is completely unnecessary to carry this any farther than till the error of the scale is less than the probable error of observation.

Let us now examine the theory of this micrometer, and endeavour to ascertain the nature of the scale for measuring the variations of the angle. For this purpose let L L, fig. 4, be the object-glass which forms an inverted image, *m n*, of the object M N, and let the semilenses A B, having their centres at an invariable distance, be interposed between the object-glass and its principal focus, in such a manner that their centres are equidistant from the axis O *f*. Now it is obvious that the size of the image *m n* is propor-

tional to the size of the object MN; and, as the angle subtended by MN depends upon its size, the magnitude of the image mn may, in the case of small angles, be assumed as a measure of the angle subtended by MN. As the rays which proceed from the point M are all converged to m, by means of the lens LL, the ray bA, which passes through the centre of the semilens A, must of course have the direction bm; and, as it suffers no refraction in passing through the centre of A, it will proceed in the same direction bAm, after emerging from the semilens, and will cross the axis at F. For the same reason the ray c B, proceeding from N, and passing through the centre of B, will cross the axis at F as it advances to n. If the distance of F from A and B happens to be equal to the focal length of the lenses A and B, when combined with LL, distinct images of M and N will be formed at F, and they will appear to touch one another; and the line mn, being the size of the image that would have been formed by the lens LL alone, will be a measure of the angle subtended by the points MN. If the point F, where the lines Am, Bn, cross the axis, should not happen to coincide with the focus of the lenses A, B, when combined with LL, then let this focus be at F′, nearer A and B than F. Draw the lines AF′m, BF′n, then it is obvious that, if the angle subtended by MN were enlarged so as to be represented by $n'm'$, instead of nm, or so that the lens LL alone would form an image of it equal to $n'm'$, the point of intersection F would coincide with the focus F′; so that in every position of the lenses A, B, with respect to LL, the points MN may always be made to subtend such an angle that, when they are placed before the telescope, the points FF′ will coincide, and consequently the images of the points MN will be distinctly formed at F′, and will be in contact. Whenever this happens the space nm will be a measure of the angle thus subtended by MN. Hence it follows that, whatever be the position of the semilenses AB, on the axis Of, the rays bA, cB, which pass through the centres of the semilenses, will cross the axis at some point F, corresponding with the focus of rays diverging from MN, and will mark out the size of the image $n'm'$, and consequently the relative magnitude of the angle subtended by the two points M, N.

From the equality of the vertical angles AF′B, n'F′m', and the parallelism of the lines AB, $n'm'$, we shall have

$$n'm' : AB = fF' : GF',$$

and calling $fF' = b$, and considering that $GF' = \frac{Fb}{F+b}$, F being the focal length of the semilenses, we have

$$n'm' : AB = b : \frac{Fb}{F+b}, \text{ and consequently}$$

$$n\,m' = AB + \frac{AB \times b}{F}.$$

Now, calling AB = 2, F = 10, and $b = 1, 2, 3$, successively, we shall obtain

$$n'm' = 2 + \frac{2 \times 1}{10} = 2{\cdot}2$$

$$n\,m' = 2 + \frac{2 \times 2}{10} = 2{\cdot}4$$

$$n'm' = 2 + \frac{2 \times 3}{10} = 2{\cdot}6;$$

from which it appears that, when b is in arithmetical progression, the angle $n'm'$ varies at the same rate; and consequently the scale, which measures the variations of the angle subtended by the centres of the two images, is a scale of equal parts.

This instrument undergoes a very singular change when constructed, as in fig. 6, so that the semilenses are outermost and immoveable, while another lens, LL, is made to move along the axis Gf. In this case a double image is formed as before, but the angle subtended by the centres of the images never suffers any change during the motion of the lens LL along the axis of the telescope. If the two images are in contact when the lens LL is close to the semilenses, they will continue in contact in every other position of LL; but the magnitude of the images is constantly increasing during the motion of LL towards f, the principal focus of the semilenses. The reason of this remarkable property will be understood from fig. 6, where MN are two objects placed at such an angle that the rays, passing through the centres AB of the semilenses, cross the axis at F, and will consequently be in contact. If the lens LL is removed to the position L′L′, the rays Mm, Nn, which are incident upon it at the points m and n, having the same degree of convergency as before, will be refracted to F′, the focus of the combined lenses for rays diverging from MN. Two distinct images of the object will therefore be formed at F′, and these images will still be in contact. In like manner it may be shown, that whatever be the position of the lens LL between G and f, the rays Mf, Nf, will cross the axis at a point coinciding with the focus of the combined lenses, and will there form two images always in contact. Hence it follows that, though the magnifying power of the instrument is constantly changing with the position of the lens LL, yet the angle subtended by the centres of the two images never suffers the least variation.

The *circular micrometer* is an instrument which has been, for many years past, much used on the continent, and is still held in high and deserved estimation there by astronomers of the first rank. From the simplicity of its construction, and the facility with which it may be used in any position of the telescope, it is frequently preferred, even in public and national observatories, to micrometers of a more complex nature, which require to be adjusted to the equatorial motion of the star. Moreover there is no necessity for its being illuminated; on which account it is peculiarly adapted to the observation of comets and small stars; and it is, indeed, to these two classes of the heavenly bodies that its application is now principally confined; although some astronomers of great eminence have considered that it is capable of equal accuracy to the wire micrometers. To voyagers and others it will prove of considerable advantage. The smallness of its size (not being much larger than a shilling) renders it very convenient for carriage; and the simplicity of its construction prevents any liability to injury.

Astronomy is indeed more indebted to this little instrument than is perhaps generally known. Three out of the four new planets which have been discovered in the present century were discovered with very small telescopes, and their motions watched, and the elements of their orbits deduced from observations made with the circular micrometer only; whereby astronomers were enabled to look out for them with certainty at the time of their re-appearance at the next oppositions. And at the present day it is almost the only instrument used on the continent for the observation of comets. To the labors of Olbers, Bessel, and Frauenhofer, we are indebted for the high reputation which this instrument has attained. To the two former for the talent which they have displayed in explaining the analysis by which the observations may be reduced; and to the latter for the recent improvements which he has introduced in the construction of the instrument.

M. Frauenhofer's micrometers are formed by means of very fine lines cut on glass with a diamond point in a peculiar manner, and placed in the focus of the telescope. One of these micrometers consists of concentric circular lines, drawn at unequal distances from each other; and the other consists of straight lines crossing each other at a given angle. The mode of cutting these lines has furnished M. Frauenhofer with a method of illuminating them, which, at the same time that it renders the lines visible, leaves the other part of the field of the telescope in darkness; so that the transits of the smallest stars may be observed by means of these micrometers, the lines appearing like so many silver threads suspended in the heavens.

The circular mother-of-pearl micrometer, which Dr. Brewster has often used, both in determining small angles in the heavens and such as are subtended by terrestrial objects, is represented in fig. 7, which exhibits its appearance in the focus of the first eye-glass. The black ring which forms part of the figure is the diaphragm, and the remaining part is an annular portion of mother-of-pearl, having its interior circumference divided into 360 equal parts. The mother-of-pearl ring, which appears connected with the diaphragm, is completely separate from it, and is fixed at the end of a brass tube, which is made to move between the third eye-glass and the diaphragm, so that the divided circumference may be placed exactly in the focus of the glass next the eye. When the micrometer is thus fitted into the telescope, the angle subtended by the whole field of view, or by the diameter of the innermost circle of the micrometer, must be determined either by measuring a base, or by the passage of an equatorial star; and the angles subtended by any number of divisions or degrees will be found by a table constructed in the following manner:—

Let A $m\ p\ n\ b$, fig. 8, be the interior circumference of the micrometer scale, and let $m\ n$ be the object to be measured. Bisect the arch $m\ n$ in p, and draw C m C p C n. The line C p will be at right angles to $m\ n$, and therefore $m\ n$ will be twice the sine of half the arch $m\ p\ n$. Consequently A B $m\ n$ = Rad. Sine of $\frac{1}{2}\ m\ p\ n$; therefore $m\ n \times \text{R} = \sin.\ \frac{1}{2}\ m\ p\ n \times \text{A B}$, and $m\ p\ n = \frac{\sin.\ \frac{1}{2}\ m\ p\ n}{\text{R}} \times \text{A B}$, a formula by which the angle subtended by the chord of any number of degrees may be easily found. The first part of the formula, viz. $\frac{\sin.\ \frac{1}{2}\ m\ p\ n}{\text{R}}$ is constant, while A B varies with the size of the micrometer, and with the magnifying power which is applied. The following table, therefore, has been computed, which contains the value of the constant part of the formula for every degree or division of the scale:—

Degrees.	Constant part of the Formula.	Degrees.	Constant part of the Formula.	Degrees.	Constant part of the Formula.	Degrees.	Constant part of the Formula.	Degrees.	Constant part of the Formula.
1	·0087	37	·3173	73	·5948	109	·8141	145	·9537
2	·0174	38	·3256	74	·6018	110	·8192	146	·9563
3	·0262	39	·3338	75	·6088	111	·8241	147	·9588
4	·0349	40	·3420	76	·6157	112	·8290	148	·9613
5	·0436	41	·3502	77	·6225	113	·8339	149	·9636
6	·0523	42	·3584	78	·6293	114	·8387	150	·9659
7	·0610	43	·3665	79	·6361	115	·8434	151	·9681
8	·0698	44	·3746	80	·6428	116	·8480	152	·9703
9	·0785	45	·3827	81	·6494	117	·8526	153	·9724
10	·0872	46	·3907	82	·6561	118	·8572	154	·9744
11	·0958	47	·3987	83	·6626	119	·8616	155	·9763
12	·1045	48	·4067	84	·6691	120	·8660	156	·9781
13	·1132	49	·4147	85	·6756	121	·8704	157	·9799
14	·1219	50	·4226	86	·6820	122	·8746	158	·9816
15	·1305	51	·4305	87	·6884	123	·8788	159	·9833
16	·1392	52	·4384	88	·6947	124	·8829	160	·9848
17	·1478	53	·4462	89	·7009	125	·8870	161	·9863
18	·1564	54	·4540	90	·7071	126	·8910	162	·9877
19	·1650	55	·4617	91	·7133	127	·8949	163	·9890
20	·1736	56	·4695	92	·7193	128	·8988	164	·9903
21	·1822	57	·4771	93	·7254	129	·9026	165	·9914
22	·1908	58	·4848	94	·7314	130	·9063	166	·9925
23	·1994	59	·4924	95	·7373	131	·9100	167	·9936
24	·2079	60	·5000	96	·7431	132	·9135	168	·9945
25	·2164	61	·5075	97	·7490	133	·9171	169	·9954
26	·2250	62	·5150	98	·7547	134	·9205	170	·9962
27	·2334	63	·5225	99	·7604	135	·9239	171	·9969
28	·2419	64	·5299	100	·7660	136	·9272	172	·9976
29	·2504	65	·5373	101	·7716	137	·9304	173	·9981
30	·2588	66	·5446	102	·7771	138	·9336	174	·9986
31	·2672	67	·5519	103	·7826	139	·9367	175	·9990
32	·2756	68	·5592	104	·7880	140	·9397	176	·9994
33	·2840	69	·5664	105	·7934	141	·9426	177	·9996
34	·2923	70	·5735	106	·7986	142	·9455	178	·9998
35	·3007	71	·5807	107	·8039	143	·9483	179	1·0000
36	·3090	72	·5878	108	·8090	144	·9511	180	1·0000

In order to find the angle subtended by any number of degrees we have only to multiply the constant part of the formula corresponding to that number in the table by A B, or the angle subtended by the whole field. Thus, if A B is 30′, the angle subtended by 1° of the scale will be $30' \times \cdot0087 = 15\frac{2}{3}''$, and the angle subtended by 40° will be $30' \times \cdot342 = 10'\ 15''.6$; and by making the calculation it will be found that, as the angle to be measured increases, the accuracy of the scale also increases; for, when the arch is only 1° or 2°, a variation of 1° produces a variation of about 16″ in the angle; whereas, when the arch is between 170° and 180°, the variation of a degree does not produce a change of much more than 1″ in the angle.

The *single-lens* micrometer, contrived by Dr. Wollaston, must now be adverted to. Having had occasion to measure some very small wires, with a greater degree of accuracy than he was enabled to do by any instrument hitherto made use of for such purposes, he was led to contrive other means that might more effectually answer the end proposed. The instrument to which Dr. Wollaston had recourse is furnished with a single lens of about one-twelfth of an inch focal length. The aperture of such a lens is necessarily small; so that, when it is mounted in a plate of brass, a small perforation can be made by the side of it in the brass as near to its centre as one-twenty-fifth of an inch. When a lens thus mounted is placed before the eye, for the purpose of examining any small object, the pupil is of sufficient magnitude for seeing distant objects at the same time through the adjacent perforation; so that the apparent dimensions of the magnified image might be compared with a scale of inches, feet, or yards, according to the distance at which it might be convenient to place it. A scale of smaller dimensions attached to the instrument will, however, be found preferable on account of the steadiness with which the comparison may be made; and it may be seen with sufficient distinctness by the naked eye, without any effort of nice adaptation, by reason of the smallness of the hole through which it is viewed. The construction that Dr. Wollaston chose for the scale is represented in fig. 9. It is composed of small wires, about one-fiftieth of an inch in diameter, placed side by side, so as to form a scale of

equal parts, which may with ease be counted by means of a certain regular variation of the lengths of the wires.

The external appearance of the whole instrument is that of a common telescope, consisting of three tubes. The scale occupies the place of the object-glass, and the little lens is situated at the smaller end, with a pair of plain glasses sliding before it, between which the subject of examination is to be included. This part of the apparatus is shown separately in fig. 11. It has a projection at *a*, with a perforation, through which a pin is inserted to connect it with a screw represented at *b*, fig. 10. This screw gives lateral motion to the object, so as to make it correspond with any particular part of the scale. The lens has also a small motion of adjustment by means of the cap *c*, which renders the view of the magnified object distinct.

Before the instrument is completed it is necessary to determine with precision the indications of the scale, which must be different according to the distance to which the tube is drawn out. In Dr. Wollaston's instrument one division of the scale corresponds to $\frac{1}{10000}$ of an inch when it is at the distance of 16·6 inches from the lens; and, since the apparent magnitude in small angles varies in the simple inverse ratio of this distance, each division of the same scale will correspond to $\frac{1}{5000}$ at the distance of eight inches and three-tenths, and the intermediate fractions $\frac{1}{6000}$, $\frac{1}{7000}$, &c., are found by intervals of 1·66 inch marked on the outside of the tube. The basis on which these indications were founded, in this instrument, was a wire carefully ascertained to be $\frac{1}{200}$ of an inch in diameter, the magnified image of which occupied fifty divisions of the scale, when it was at the distance if 16·6 inches, and hence one division $=\frac{1}{50\times 200}=\frac{1}{10000}$. Since any error in the original estimate of this wire must pervade all subsequent measures derived from it, the substance employed was pure gold drawn till fifty-two inches in length weighed exactly five grains. If we assume the specific gravity of gold to be 19·36, a cylindrical inch will weigh 3837 grains, and we may thence infer the diameter of such a wire to be $\frac{1}{200}$ of an inch, more nearly than can be ascertained by any other method. For the sake of rendering the scale more accurate, a similar method was in fact pursued with several gold wires, of different sizes, weighed with equal care, and the subdivisions of the exterior scale were made to correspond with the average of their indications.

In making use of this micrometer, for taking the measure of any object, it would be sufficient at any one accidental position of the tube to note the number on the outside as denominator, and to observe the number of divisions and decimal parts which the subject of examination occupies, on the interior scale, as numerator of a fraction expressing its dimensions in proportional parts of an inch; but it is preferable to obtain an integer as numerator, by sliding the tube inward or outward till the image of the wire is seen to correspond with some exact number of divisions, not only for the sake of the greater simplicity in the arithmetical computation, but because we can by the eye judge more accurately of actual coincidence, than of the comparative magnitudes of adjacent intervals.

The smallest quantity, which the graduations of this instrument profess to measure, is less than the eye can readily appreciate in sliding the tube inward or outward. If, for instance, the object measured be nearly $\frac{1}{5000}$, it may appear $\frac{1}{10000}$, or $\frac{1}{9800}$, in which case the doubt amounts to one-fiftieth part of the whole quantity. But the difference is here exceedingly small in comparison to the extreme division of other instruments where the nominal extent of its power is the same. A micrometer with a divided eye-glass may profess to measure as far as $\frac{1}{10000}$ of an inch; but the next division is $\frac{1}{10000}$ or $\frac{1}{5000}$; and, though the eye may be able to distinguish that the truth lies between the two, it receives no assistance within one-half part of the larger measure.

We may now notice the micrometer made of *rock crystal* suggested by Mr. Dollond. Rock crystal having been applied to telescopes in various ways, for the purposes of micrometrical measurements, particularly that which is recommended by M. Arago, induced him to consider if a more simple mode of applying the crystal could not be discovered, and the following account of its application to the eye-tube of a telescope is the result.

The improvement consists in making a sphere or lens from a piece of rock crystal, and adapting it to a telescope in the place of the usual eye-glass; and, from its natural double refracting power, rendering it useful as a micrometer.

The advantages of thus applying the crystal are, in the first place, the great saving of the time required to find the proper angle for cutting the crystal; also of cutting the prisms to their proper angles, and working their surfaces with sufficient accuracy to render them useful as micrometers, in the manner that is recommended by M. Arago, Dr. Wollaston, and others.

Upon this plan it is only necessary to select a piece of perfect crystal; and, without any knowledge of the angle that will give the greatest double refraction, to form the sphere of a proper diameter for the focal length required.

The second advantage is derived from being able to take the angle on each side zero, without reversing the eye-tube; also of taking intermediate angles between zero and the greatest separation of the images, without exchanging any part of the eye-tube, it being only required to move the axis in which the sphere is placed.

Thirdly, it possesses the property of an eye-tube or lens that is not intended for micrometrical measurements; for, when the axis of the crystal is parallel to the axis of the object-glass of the telescope, only one image will be formed, and that will be as distinctly formed as with any lens that does not posses the double refracting property.

The eye-tube is so constructed that the plane through which the two images move can be placed parallel to the line in the object which is to be measured; and, if this motion is furnished with a divided circle, it will correctly answer the purpose of a position micrometer.

The value of the scale is found from the known diameter of any distan object, and will

vary in proportion to the magnifying powers of the eye-tube; its value increasing in proportion to the increase of those magnifying powers.

Fig. 12 is a section of the eye-tube; and fig. 13 a general view of the same; both of the full size.

The sphere, or lens, *a*, fig. 12, is formed of rock crystal, and placed in half holes, from which is extended the axis *b b*, with an index attached; which index registers the motion of the sphere, the extent of that motion being shown upon the divided face C, fig. 13. The sphere is so placed in the half holes that, when its natural axis is parallel to the axis of the telescope, only one image of the object is seen. In the other direction, or that which is at right angles to the axis of motion, it must be so placed that when it is moved the separation of the images, viz. the ordinary and extraordinary, may be parallel to that motion. The method of acquiring this adjustment is, by turning the sphere in the half holes parallel to its own axis.

The field of view of the eye-tube is increased, and the magnifying power varied, by the introduction of the lens *d*, fig. 12, between the sphere and the primary image of the object-glass; and its distance from the sphere will be in proportion to the magnifying power required; the magnifying powers are engraved upon the eye-tube at *e*, and will vary in proportion to the focal length of the object-glass to which the eye-tube is applied. Those marked in the figure are for an object-glass of forty-four inches in focal length.

The object of Mr. Babbage's new *zenith* micrometer is to supersede the necessity of extreme accuracy in the divisions. The principle on which this instrument depends may be readily comprehended by imagining a parallelogram, admitting of free motion about its four angles, to be placed with two of its sides in a horizontal position, and the whole in a vertical plane, and a telescope to be fixed at right angles to the lower horizontal bar of this parallelogram. Here every motion of one of the perpendicular bars of the instrument round its upper joint will not change the angle which the telescope makes with the meridian; but will merely remove it into a new position in which it will point to the same object in the heavens. But, if either of the horizontal bars of the instrument be lengthened by a very small quantity, this parallelism of the telescope will no longer be preserved; but any movement of the upright bars round their axes will not only remove the telescope from its position, but will cause it to form a very small angle with its former direction. The magnitude of that angle will depend on the alteration in the length of the arm of the parallelogram, and also on the angle which that arm makes with its first direction. The arc which is actually measured in the heavens, by means of this instrument, is determined by a formula in which the sum of three arcs is taken from the semicircumference, one of them resulting from the actual observation; the other two from a cosine and a tangent, ascertainable by computation from the theorem itself. In an extensive use of this micrometer tables may easily be formed to faci·tate the computation.

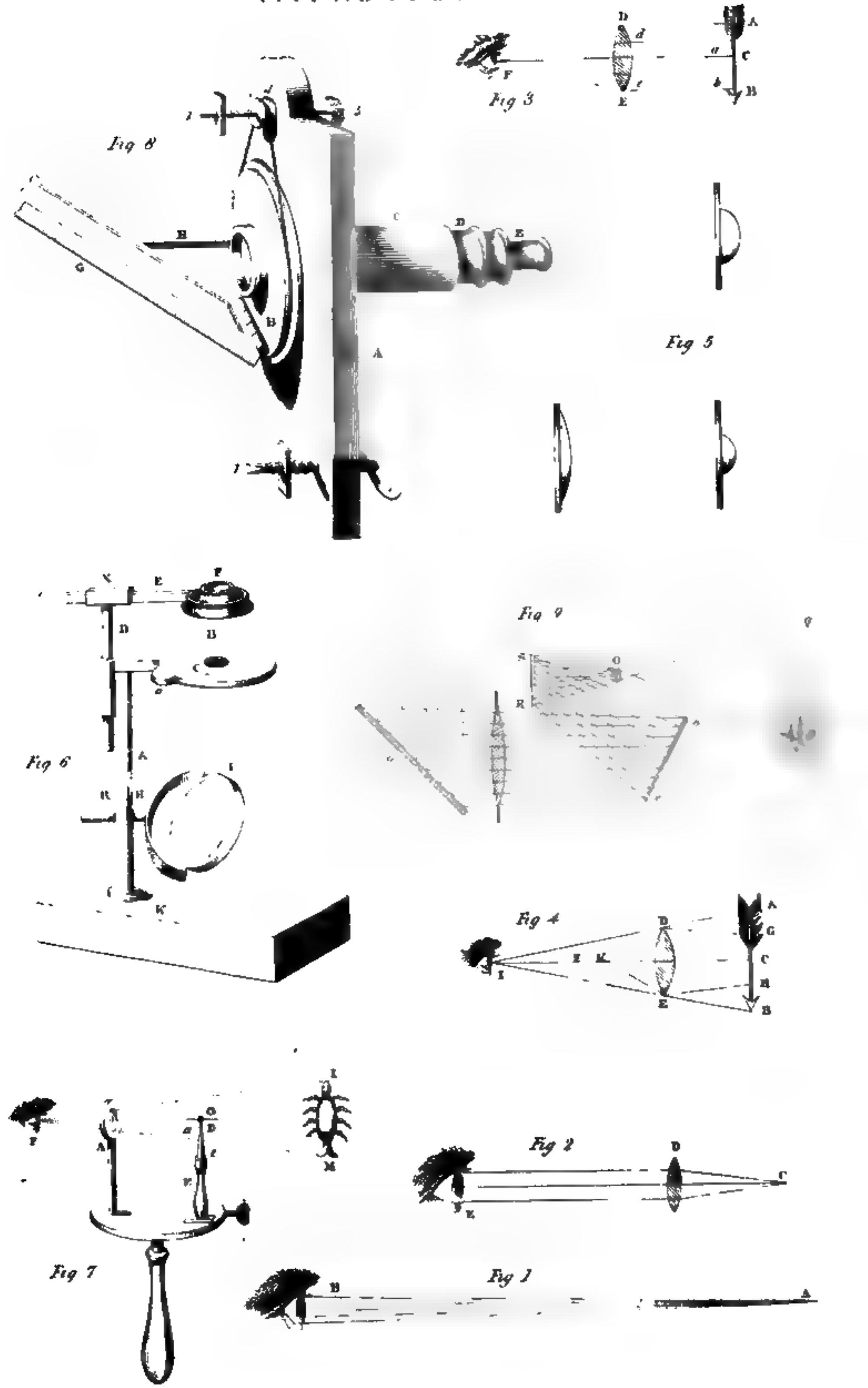
It may now be advisable to examine the *fibres* proper for micrometers, and on the method of adjusting them to the eye-piece.

In the micrometer constructed by Huygens the object whose angle was required was comprehended between the edges of two plates of brass. Silver wires, and sometimes hairs, were afterwards substituted instead of the plates, and continued in use till about the end of the last century. The finest silver wire ever made was drawn in France to the thickness of $\frac{1}{1000}$ of an inch. The plates used for this purpose, and the secret of making them, are said to have been lost amid the convulsions of the revolution. The smallest wire which is made in this country does not exceed $\frac{1}{500}$th of an inch.

The impossibility of obtaining wire of a diameter sufficiently minute for micrometers induced Felix Fontana, in 1775, to recommend the spider's web as an excellent substitute for silver wire. This suggestion of Fontana, however, did not excite much notice, till the use of the spider's web was introduced by the late celebrated Mr. Troughton, who found this fibre to be so fine, opaque, and elastic, as to answer all the objects of practical astronomy. We are informed, however, by this distinguished artist, that it is only the stretcher, or the long line which supports the web, that possesses these valuable properties. The other parts of the web, though equally fine and elastic, are very transparent, and therefore completely unfit for micrometrical purposes. The difficulty of procuring the proper part of the spider's web has compelled many opticians and practical astronomers to employ the raw fibre of unwrought silk, or, what is much worse, the coarse silver wire which is manufactured in this country. But, whatever be the comparative advantages of these different substances, they are all liable to the error arising from the inflexion of light, which renders it impossible to ascertain the exact contact between the fibre and the luminous body. This disadvantage has been experienced by every astronomical observer and has always been considered as inseparable from the wire micrometer. After numerous trials, Dr. Brewster succeeded in obtaining a delicate fibre, which appears to remove the error of inflexion while it possesses the requisite properties of opacity and elasticity. This fibre is glass, which is so exceedingly delicate that it can be drawn to any degree of fineness, and can always be procured and prepared with facility; a circumstance of no small importance to the practical astronomer, who is frequently obliged to send his micrometers to a great distance when they require to be repaired.

When the vitreous fibre is formed, and stretched across the diaphragm of the eye-piece of a telescope, it will appear perfectly opaque, with a delicate line of light extending along its axis. This central transparency arises from the refraction of the light which falls upon the edges of the cylindrical fibre, and therefore the diameter of the luminous streak must vary with that of the fibre itself. In a micrometer which Dr. Brewster fitted up in this way the glass fibres are about the 1200th part of an inch in diameter, and the fringe of light which stretches across

MICROSCOPE.



J. Shury Sculp

London Published by Thomas Tegg & Son 73, Cheapside

their axis, is distinctly visible, though it does not exceed in diameter the $\frac{1}{3000}$th part of an inch. In using these fibres for measuring the angle subtended by two luminous points, whether they be two stars, or the opposite extremities of a luminous disc, we may, as has hitherto been done, separate the fibres till the luminous points are in contact with their interior surfaces; but, in order to avoid the error arising from inflexion, Dr. B. proposes that the separation should be continued till the rays of light issuing from the luminous points dart through the transparent axes of the fibres. The rays, thus transmitted, suffer no inflexion in passing through the fibre to the eye; and, besides this advantage, we have the benefit of a delicate line, about one-third of the diameter of the fibre itself.

On some occasions Dr. Brewster employed threads of melted sealing-wax, which may be made extremely fine, though not of such a regular diameter as silver wire, or the fibres of glass. It is a very singular fact, that one of these fibres of wax was exposed, without injury, to the heat of the sun, concentrated in the focus of an object-glass, with an aperture of 2·3 inches, and twenty-nine inches in focal length.

These fibres are placed in delicate parallel grooves formed upon the diaphragm of the first eye-glass, and may be fixed in their places for temporary purposes by a thin layer of bees-wax; but, when they are required to be kept at an invariable distance, it is safer to pinch them to the diaphragm by a small screw-nail near the extremity of each wire.

The diaphragm should be constructed so as to move along the axis of the eye-piece, in order that the fibres may be placed exactly in the anterior focus of the first eye-glass; and, before any observation is made, the eye of the observer ought to be fixed for a short time upon the fibres alone, till it is accommodated to that distance; and, while it is thus fixed, distinct vision should be produced by the motion of the eye-tube. By attending to this suggestion, which is of great practical importance, the rays that diverge from the fibres, and those that diverge from the distinct image, will unite on the same points of the retina. From the great facility which the eye possesses of adjusting itself to different distances, the adaptation of that organ, to the fibres and to the image, could not have been effected by looking at the image alone, while distinct vision was produced by the motion of the eye piece; for, as the eye has not any permanent focus like a lens, the image might appear distinct before the pencils of rays had actually converged to a point; and, when this does happen, the rays proceeding from the fibres cannot unite with those proceeding from the image on the same points of the retina.

When the micrometer is employed in terrestrial observations the end of the eye-tube, into which the observer looks, should be furnished with an aperture smaller than that which is used for common purposes, and this small aperture should be used when the sun shines, or when the light of the day is very great. If the fibres happen to be small, they will either cease to become visible in very strong light, or will appear to have a kind of vibratory motion which injures the eye of the observer, and prevents him from making the observation. Hence it becomes necessary to diminish the light by means of a small aperture.

Professor Wallace, of the Royal Military College, has suggested the employment of asbestos fibres in lieu of the fine wire or spider's web; and a filament about $\frac{1}{5000}$ of an inch in diameter, having been applied to a telescope, was found to answer very perfectly the purpose for which it was intended.

The inventive genius of Dr. Wollaston has, however, far outstripped those who preceded him in the production of a micrometer fibre. The contrivance by which it is effected, is so ingenious, and promises to be productive of such valuable results, that it may be advisable to notice the account of the process employed by this philosopher:—

The extremity of a platinum wire having been fused into a globule nearly one-fourth of an inch in diameter, was next hammered out into a square rod, and then drawn again into a wire $\frac{1}{253}$ of an inch in diameter. One inch of this wire duly coated with silver, was drawn till its length was extended to 182 inches; consequently the proportional diminution of the diameter of the platina will be expressed by the square root of 182, so that its measure had become $\frac{1}{253 \times 13 \cdot 5} = \frac{1}{3425}$. The specific gravity of the coated wire was assumed to be 10·5; and since the weight of 100 inches was 114 grains, its diameter was inferred to be $\frac{1}{42 \cdot 8}$th of an inch, or just eighty times that of the platina contained in it.

MICROPUS, bastard cudweed, a genus of the polygamia necessaria order, and, syngenesia class of plants; natural order forty-ninth, compositæ; receptacle paleaceous: CAL. calyculated; there is no radius of the corolla. The female florets are wrapped in the scales of the calyx. There are two species; viz.

1. M. erectus, and

2. M. supinus. The latter only is cultivated in gardens. It is an annual plant, growing naturally in Portugal, in places near the sea. The root sends out several trailing stalks, about six or eight inches long, which are garnished with small, oval, silvery leaves, whose bases embrace the stalks. The flowers come out in clusters from the wings of the stalks, and are very small, and of a white color. It flowers in June and July: and is frequently preserved in gardens on account of its silvery leaves. It is easily propagated by seed sown in autumn, and requires no other culture but to be kept free from weeds.

MICROSCOPE.—This instrument has tended most materially to enlarge the boundaries of our knowledge in almost every branch of natural history. Its invention is attributed by the celebrated Dutch mathematician, Huygens, to a countryman of his, named Drebell (for it must be observed that it was entirely lost in the middle ages). He constructed them about the year 1621, or thirty-one years after the invention of the telescope.

According to Borelli, the microscope was invented by Jansen, the reputed contriver of the

telescope, who presented some instruments of his first construction to prince Maurice, and Albert archduke of Austria. These instruments were six feet in length, and consisted of a tube of gilt copper, one inch in diameter, supported by thin brass pillars, in the shape of dolphins, on a base of ebony which was adapted to hold the objects to be examined. Of the internal construction of this microscope we have no precise account; though there is reason to think that it was nothing more than a telescope converted into a compound microscope.

The construction both of single and compound microscopes has, within the last fifty years, been brought to a degree of perfection; and for all the purposes of amusement, and general observation, these instruments may be considered as sufficiently perfect. But when we employ the microscope as an instrument of discovery, to examine those phenomena of the natural world which are beyond the reach of unassisted vision, and when we use it in ascertaining the anatomical and physiological structure of plants, insects, and animalcula, we soon find that a limit, apparently insuperable, is set to the progress of discovery, and that it is only some of the ruder and more palpable functions of these evanescent animals that we are able to bring under observation. Naturalists, indeed, are less acquainted with the organisation of the microscopic world, and the beings by which it is peopled, than astronomers are with those remote systems of the universe which appear in the form of nebulæ and double stars. It was the improvement of the telescope alone which enabled Dr. Herschel to fix the views of astronomers upon those regions of space, to which, at a former period, their imaginations could scarcely extend; and, when the microscope shall have received a similar improvement, we may look for discoveries equally interesting, though less stupendous, even in those portions of space which are daily trampled under the foot of man.

It is both important and interesting to enquire into the cause of this limitation of microscopical discovery. The construction of single lenses, for the simplest form of the instrument, has been brought to great perfection. Dr. Brewster has in his possession glasses, executed by Mr. Shuttleworth, of the focal length of one-thirtieth, one-fortieth, and one-fiftieth of an inch, which are ground with great accuracy; and the performance of single lenses has been recently improved by Dr. Wollaston, who separates two hemispherical segments by means of a small plate of brass perforated in the centre. We cannot, therefore, expect any essential improvement in the single microscope, unless from the discovery of some transparent substance, which, like the diamond, combines a high refractive power with a low power of dispersion.

It is usual to say that the microscope magnifies objects seen through it; but this is true only with regard to the apparent, not the real magnitude of objects; they indeed appear to be larger with, than without the microscope, but in truth they are not; and the reason why they appear to be magnified will be easy to apprehend. by any person who understands the nature of the optic angle. The apparent magnitude of objects is measured by the angle which they are seen under by the eye; and those angles are reciprocally as the distances from the eye. If, therefore, at the distance of six inches, we can but just discern an object, and then, by interposing a lens, or other body, we can view that very object at a nearer distance, the object will appear to be as much larger through the lens than before, to the naked eye, as its distance from the lens is less than its distance from the eye. See OPTICS.

That this is the case, is evident from fig. 1, plate MICROSCOPE, where A is a point in an object not clearly visible to the naked eye, at a less distance than A B, because the rays which proceed from it are too divergent to admit of distinct vision till they have passed that distance; but if the same object be placed in the focus C of the lens D, fig. 2, the rays which proceed from it will become parallel, by passing through the said lens, and therefore the object is distinctly visible to the eye E, placed any where before the lens D. Consequently it will appear as much larger through the lens than to the naked eye, as C D is less than A B.

If an object, A B, fig. 3, be placed in one focus C, of a lens D E, and the eye in the other focus F, the eye will see just so much of the object as is equal to the diameter of the lens; for the rays A D and B E, which go from the object to the extremities of the lens D and E, and are united at the focus F, must necessarily proceed from the object to the lens parallel to the axis F C, and therefore parallel to each other; consequently the part of the object A B, seen by the rays D F, E F, will be equal to the diameter D E of the said lens.

If only the part *d e* of the lens be open, then only so much of the object *a b* as is equal thereto will be perceived by the eye. Now, since A B is equal to D E, or *a b* to *d e*, therefore the angle D F E, or *d* F *e*, is the optic angle under which the part of the object A B, or *a b*, appears to the eye at F; and, since G F is but one-half F C, therefore the angle D F E, or *d* F *e*, is double to that under which the part A B, or *a b*, would appear to the naked eye at the distance F C; that is, the eye sees the object, situate as above, twice as large with the lens as it would do without it.

If you would see a portion of an object larger than the lens, your eye must be placed nearer the lens than its focus. Let the lens be D E, fig. 4, its two foci F and C; in the focus C, let there be an object, A B, larger than the lens; suppose the rays A D, B E, proceed from the extremities of the object to those of the lens; it is evident from the figure they will be convergent, and therefore will, by the lens, be united in a point K, between the lens D E and its focus F: if then the eye be placed at K, it will take into its view an object greater than the lens D E.

Again, let G H be a portion of an object, A B, less than the lens D E; draw G D, H E, which will be diverging rays, and therefore will be united at a point I, farther distant from the lens than the focus F; hence, if an eye be placed farther from the lens than its focal distance, it can never see any object, or part of an object, at one view, so large as the lens, but always smaller.

And universally, the visible part of an object will be to the lens, as the focal distance of the lens to the distance of the eye.

Since then it is evident the nature of a convex lens is such as will render an object distinctly visible to the eye at the distance of its focus, the reason why they are used as microscopes is very plain. For suppose the distance A B, figs. 1 and 2, be six inches, where the naked eye B can but just perceive the object A distinctly, and let the focal distance C D of the lens D be half an inch; then, since C D is but one-twelfth of A B, the length of the object at C will appear twelve times as large as at A: if it were a surface, it would be 144 times as great, and the solidity or bulk would be magnified 1728 times.

If C D, the focal distance of the lens D, be but one-fourth part of an inch, then will that be but one-twenty-fourth of A B, equal six inches, and so the length of objects will be magnified twenty-four times, the surface 576 times, and the solidity 13,824 times; for those numbers are the square and cube of twenty-four. Whence it appears, that single glass lenses make very good microscopes, which have these advantages, that the object appears most clear, they occupy little room, are extremely portable, are procured at a small expense, and are more easily used.

Various methods have at different times been described, by means of which persons of ordinary ingenuity may construct for themselves single microscopes of a very high magnifying power, and possessing a very considerable degree of distinctness. The most common method is to take up with the point of a wetted wire several small fragments of crown glass, and to hold them in the flame of a candle till round globules are formed upon them. These globules, being carefully detached, are placed between two plates of lead, copper, or brass, the fractured part being carefully kept out of the field of view. The method recommended by Mr. Gray, of making microscopes of drops of water, can be considered in no other light than as an amusing experiment; and the single microscopes made by drops of transparent varnish, upon one or both sides of a plate of glass, and tried by Dr. Brewster, though they give excellent images, are still deficient both in portability and durability. The defect of the glass globules formed by the ordinary method is, that we cannot increase their diameter beyond a very small size; that it is difficult to give them a perfect figure; and that there is considerable trouble in fixing them in the brass or copper after they are made.

The following method, proposed and executed by Mr. Siveright, is free from the greater part of these defects, and will no doubt be considered as a valuable acquisition by those who either cannot afford to purchase expensive microscopes, or who are at such a distance from an optician that they cannot be supplied in any other way. Take a piece of platinum leaf, about the thickness of tinfoil, and make two or three circular holes in it, from one-twentieth to one-tenth of an inch in diameter, and at the distance of about half an inch from each other. In the holes put pieces of glass, which will stick in them without falling through, and which are thick enough to fill the apertures. When the glass is melted at the flame of a candle with the blow-pipe, it forms a lens which adheres strongly to the metal, and the lens is therefore set and formed at the same time. The pieces of glass used for this purpose should have no mark of a diamond or file upon them, as the mark always remains, however strongly they are heated with the blow-pipe.

The lenses which were made larger than one-tenth of an inch were not so good as the rest, and the best were even of a smaller size than one-tenth. As the lenses thus formed sometimes contain air bubbles, the best way is to make several, and select those which are freest from faults. An eye or loop, made by bending the extremity of a platinum wire, may be used instead of the platinum leaf. The reason for using platinum is, that the glass is more easily and perfectly melted in this than in other metals, which may perhaps arise from its being a bad conductor of heat, and from preserving its brightness. As platinum does not oxidate, the glass adheres better to the edges of the hole, and it may be used very thin, as it does not melt with the heat necessary for the complete fusion of the glass.

The first idea of *fluid microscopes* was suggested by Mr. Stephen Gray, who published an account of them in the Philosophical Transactions. They consisted merely of a drop of water, which was taken up on the point of a pin, and placed in a small hole one-thirtieth of an inch in diameter, in the middle of a spherical cavity about one-eighth of an inch broad, and a little deeper than half the thickness of the plate. On the opposite side of the plate was another spherical cavity, half as broad as the former, and so deep as to reduce the circumference of the small hole to a sharp edge. When the water is placed in these cavities, it will form a double convex lens with unequal convexities, which may be employed like any other single microscope in the examination of minute objects.

As water, however, has a considerable dispersive power, and a low power of refraction, fluid microscopes of a more perfect kind may be formed by using sulphuric acid, castor oil, oil of ambergris, or alcohol. The sulphuric acid has a very low dispersive power, and a greater refractive power than water, and will, therefore, make a more perfect lens than any other fluid body. Castor oil may be employed with almost equal advantage; and oil of ambergris and alcohol would answer the same purpose from their optical properties, though their volatility may render them less easily managed. The best method, however, of constructing fluid microscopes, is to take Canada balsam, balsam of capivi, or pure turpentine varnish, and let a drop of any of them fall upon a thin piece of parallel glass. The drop will form a plano-convex lens, and its focal length may be regulated by the quantity of fluid which is used. These fluid lenses are represented in fig. 5, as suspended upon the parallel glass; but the proper position is when the plate of glass is horizontal. If the lens is uppermost, the gravity of the fluid will make it more flat, and diminish its focal length. This, however, may be avoided, and the contrary effect produced, by inverting the piece of glass

If these lenses are preserved from dust, they will be as durable as those which are made of glass; and, when thick Canada balsam is used, the lenses will soon be indurated into a hard gummy substance, and resist any change of figure from the gravitation of their parts.

Ellis's single, or aquatic microscope is represented in fig. 6, where K is the box that contains the whole apparatus, which is generally made of fish-skin; on the top of the box there is a female screw for receiving the screw which is at the bottom of the brass pillar A, and which is to be screwed on the top of the box K. D, a brass pin, which fits into the pillar: on the top of the pin is a hollow socket to receive the arm which carries the magnifiers: the pin is to be moved up and down, in order to adjust the lenses to their focal or proper distances from the object.

In the representation of this microscope, the pin D is delineated as passing through a socket at one side of the pillar A: it is now usual to make it pass down a hole bored down the middle of the pillar. F, the box which carries the magnifying lens; it fits into the socket X, which is at the top of the pillar D. This arm may be moved backwards and forwards in the socket X, and sideways by the pin D, so that the magnifier, which is screwed into the ring at the end F of this box, may be easily made to traverse over any part of the object lying on the stage, or plate B. F is a polished silver speculum, with a magnifying lens placed at the centre thereof, which is perforated for this purpose. H, a brass semicircle which supports the mirror I; the pin R, affixed to the semicircle H, passes through the hole which is towards the bottom of the pillar A. B, the stage on which the objects are to be placed; it fits into a small dovetailed arm which is at the upper end of the pillar A. C, a plane glass, with a small piece of black silk stuck on it. This glass is fitted to a groove made in the stage B; a pair of nippers is fixed to the hole of the stage *a*, by the pin K; the steel wire of these nippers slides backwards and forwards in the socket; and this socket is moveable upwards and downwards, by means of the joint, so that the position of the object may be varied at pleasure. The object may be fixed in the nippers, or stuck on the point. To use this microscope, begin by screwing the pillar A to the cover; pass the pin R of the semicircle which carries the mirror through the hole that is near the bottom of the pillar A; push up the stage into the dovetail at B: slide the pin into the pillar; then pass the bar E through the socket X, which is at the top of the pin D, and screw one of the magnifying lenses into the ring at F. Now place the object either on the stage or in the nippers L, and in such a manner that it may be as nearly as possible over the centre of the stage; bring the speculum F over the part you mean to observe; then get as much light on the speculum as you can, by means of the mirror I. The light received on the speculum is reflected by it on the object. The distance of the lens F from the object is regulated by moving the pin D up and down until a distinct view of it be obtained. The rule usually observed is, to place the lens beyond its focal distance from the object, and then gradually slide it down until the object appear sharp and well defined. The adjustment of the lenses to their foci, and the distribution of the light on the object, are what require most attention. These microscopes are sometimes fitted up with a rack and pinion to the pillar A, and pin D, for the more ready adjustment of the glasses to their proper foci.

The form of a very convenient microscope is represented in fig. 7, where A B is a circular piece of wood, ivory, &c., in the middle of which is a small hole, one-twentieth of an inch in diameter; upon this hole is fixed, with a wire, a small lens C, whose focal distance is C D. At that distance is a pair of plyers D E, which may be adjusted by means of the sliding-screw, as in the figure, and opened by means of the two little studs *a e*; with these you take up any small object O, and view it with the eye placed in the other focus of the lens at F; and according to the focal length of the lens, the object O will appear more or less magnified, as represented at T M. If the focal length be half or one-fourth of an inch, the length, surface, and bulk, of an object, will be magnified as before described. This small instrument may be put into a case, and carried about in the pocket without any incumbrance. Those lenses whose focal lengths are three-tenths, four-tenths, and five-tenths of an inch, are the best for common use.

In the combination of single lenses to form the compound microscope, opticians have arrived at a great degree of perfection. The aberration of refrangibility can now be completely removed by a suitable arrangement of the individual lenses; and every artifice has been exhausted in suiting the apparatus to the various tastes of the purchasers, and to every purpose of popular observation. No attempt, however, appears to have been made by opticians to fit up the microscope as an instrument of discovery, to second the labors of the naturalist in preparing the subjects of his research, and to accommodate the instrument to that particular kind of preparation which is indispensably necessary for the preservation and inspection of minute objects.

In perusing the writings of those naturalists who have applied the microscope to the examination of minute objects, we find that the most difficult and perplexing part of their labor consisted in preserving and preparing the different insects and substances which they wished to inspect. Small insects instantly shrivel up, and lose their natural form as soon as they are killed, and the minute parts of plants suffer a similar change from exposure to the air. Hence Swammerdam and Lionet killed the insects which they meant to examine by suffocating them, either in water, spirit of turpentine, or diluted spirits of wine. The softness and transparency of their parts were thus preserved during the process of dissection, and, when they were completely developed, the insect was allowed to dry before it was presented to the microscope. Its parts were consequently contracted, and lost not only their proper shape, but that plumpness, and that freshness of color, which they possessed when alive.

In the preparation, indeed, of almost every object of natural history that is composed of minute and delicate parts, it must be pre-

served by immersion in a fluid; the dissection must often be performed in the same medium; it must be freed from all adhesive and extraneous substances, by maceration and ablution in water; and, when it has undergone these operations, it is in a state of perfection for the microscope. Every subsequent change which it undergoes is highly injurious; it shrivels and collapses by being dried, its natural polish and brilliancy are impaired; the minute parts, such as the horns and down adhere to one another; and the general form of the object, as well as the disposition of its individual parts, can no longer be distinctly seen. It is therefore a matter of considerable importance to be able to examine the object when wet, and before it has suffered any of these changes; and, by fitting up the microscope in the following manner, this may be effected without even exposing the object to the air.

The object-glass of the compound microscope should have the radius of the immersed surface about nine times the focal distance of the lens, and the side next the eye about three-fifths of the same distance. This lens should be fixed into its tube with a cement which will resist the action of water or spirits of wine; and the tube, or the part of it which holds the lens, should have an universal motion, so that the axis of the lens may coincide to the utmost exactness with the axis of the tubes which contain the other glasses.

Several small glass vessels must then be provided, having different depths, from one inch to three inches, and having their bottom composed of a flat piece of glass, for the purpose of admitting freely the reflected light which is intended to illuminate the object. The fluid in which the object has been preserved, or prepared, is next put into the vessel; and the object itself placed upon a glass stage, or, if necessary, fixed to it, is immersed in the fluid. The glass vessel is now laid upon the arm of the microscope, which usually holds the object, and the lens is brought into contact with the fluid in the vessel. The rays which divide from the object emerge directly from the fluid into the object-glass, and therefore suffer a less refraction than if it had been made from air; but the focal length of the lens is very little increased, on account of the great radius of its anterior surface. The object may now be observed with perfect distinctness; unaffected by any agitation of the fluid, its parts will be seen in their finest state of preservation; delicate muscular fibres, and the hairs and down upon insects, will be kept separate by the buoyancy of the fluid; and if the object, when alive, or in its most perfect state, had a smooth surface, its natural polish will not only be preserved but heightened by contact with the fluid. Aquatic plants and animals will thus be seen with unusual distinctness, and shells and unpolished minerals will have a brilliancy communicated to their surfaces which they could never have received from the hands of the lapidary. If the specific gravity of the substance under examimination should happen to be less than that of the fluid, and if it cannot easily be fixed to the glass stage, it may be kept from rising to the top by a piece of thin parallel glass, or by a small grating of silver wire stretched across the vessel.

In order to find the magnifying power of such a microscope, let $f =$ focal length of object-glass; $F =$ focal length of amplifying-glass; $d =$ distance of object from object-glass; $D =$ distance between the object-glass and the amplifying-glass; $m =$ magnifying power of the eye-glass; $M =$ magnifying power of the microscope. Then we shall find—

$$x = \frac{d f}{d - f} - D, \text{ and}$$

$$M = \frac{F}{x + F} \times \frac{f}{d - f} \times m$$

When the object-glass is equally convex, and when its anterior surface is immersed in water we shall have

$$x = \frac{1{\cdot}37 f d}{d - 1{\cdot}37 f}, \text{ and}$$

$$M = \frac{F}{x + F} \times \frac{1{\cdot}37 f}{d - 1{\cdot}37 f} \times m$$

When the object-glass is unequally convex, and a b are its radii, a being immersed in water, we shall have $f = \frac{5 a b}{2{\cdot}65 a + b}$; and, by using the value of f in the first equations, the magnifying power will be proved.

The method of fitting up and using the compound microscope, which has now been described, enables us, in a very simple manner, to render the object-glass perfectly achromatic without the assistance of any additional lens. The rays which proceed from the object immersed in the fluid will form an image of it nearly at the same distance behind the lens as if the object had been placed in air, and the rays transmitted through a plain concave lens of the fluid combined with the object-glass. If we, therefore, employ a fluid whose dispersive power exceeds that of the object-glass, and accommodate the radius of the anterior surface of that lens to the difference of their dispersive powers, the image will be formed perfectly free from any of the primary colors of the spectrum. The fluids most proper for this purpose are:—

Oil of cassia,	Oil of sassafras,
Oil of aniseseeds,	Oil of sweet fennel seeds
Oil of cummin,	Oil of spearmint,
Oil of cloves,	Oil of pimento.

These oils are arranged in the order of their dispersive powers; and, when those at the top of the list are used, the anterior surface of the object-glass will require a greater radius of curvature than when those at the bottom of the list are employed. Thus, in order to render the object-glass achromatic when it is made of crown glass, and when the fluid is oil of cassia, the radius of the anterior or immersed surface should be to that of the surface next the eye as 2·5 to 1. Lest these proportions should not exactly correct the chromatic aberration, it would be preferable to make the radii as 2·2 to 1, and then reduce the dispersive power of the oil of cassia by oil of olives, or any other less dispersive oil, till the correction of color is complete

If the oil of sweet fennel seeds is used, the radius of the anterior should be to that of the posterior surface as 0·8 to 1.

The *camera obscura* microscope is usually composed of a tube, a reflecting mirror, and a convex lens, in addition to the ordinary microscopic apparatus. The sun's rays being directed by the looking-glass through the tube upon the object, the image or picture is thrown distinctly and beautifully upon a screen of white paper, or a white linen sheet, placed at some distance to receive it, and considerably magnified. The apparatus for this purpose, as represented in fig. 8, is as follows: A, a square wooden frame, through which two long screws pass, and by means of two nuts, 1, 1, fasten it firmly to a window shutter, in which a hole is made for its reception, the two nuts being let into the shutter.

A circular hole is made in the middle of this frame to receive a piece of wood of a circular figure B. The edge projects a little beyond the frame, and contains a shallow groove furnished with a band, which, by twisting round and then crossing over a brass pulley 4, affords an easy motion for turning round the circular piece of wood B, with its connecting parts, to follow the course of the sun. C is a brass tube screwed into the middle of the circular piece of wood, forming a case for the uncovered brass tube D, which may be drawn backwards or forwards. E a smaller tube of about one inch in length, screwed to the end of the larger tube D.

In the large tube is a convex lens, whose focus is about twelve inches, designed to collect the sun's rays, and throw them more strongly upon the object. G a looking-glass of an oblong figure, set in a wooden frame, fastened by hinges to the circular piece of wood B, round which it revolves.

H a jointed wire passing through the wooden frame to enable the observer, by putting it backwards or forwards, to elevate or depress the glass, according to the sun's altitude.

When the microscope is employed the room must be rendered as dark as possible; for on the darkness of the room, and the brightness of the sun-rays, depend the sharpness and perfection of the image. Then, putting the looking-glass G through the hole in the window-shutter, the observer must fasten the square frame A to the said shutter by its two screws and nuts 1, 1; this done, adjust the looking-glass to the elevation and situation of the sun by means of the jointed wire H, together with the pulley and band.

As soon as this appears, screw the tube C into the brass collar provided for it in the middle of the woodwork, taking care not to alter the looking-glass; then, screwing the magnifier to be employed to the end of the microscope, take away the lens at the other end, and place a slider, containing the object to be examined, between the thin brass plates, as in the common microscope.

Things being thus prepared, screw the body of the microscope to the short brass tube E, and pull out the tube D, less or more, as the object is capable of enduring the sun's heat. Dead objects may be brought within about an inch of the focus of the convex lens; but the distance must be altered for living insects, or they will speedily be deprived of life. The short tube E, which the microscope is screwed to, enables the observer, by moving it backwards or forwards in the tube D, to bring the objects to their true focal distance, which will be known by the sharpness and clearness of their appearance; they may also be turned round by the same means without the effect being injured.

The solar microscope we have just been examining is calculated only to exhibit transparent objects, or at least such as permit a part of the incident light to pass through them; to view opaque objects another mirror must be used, in order that they may be seen by the light that they reflect.

In fig. 9 the mirror *a*, and the lens *c*, are the same as in the common solar microscope; but the converging rays from *c* are met by a mirror *e n*, placed diagonally, and which reflects the rays upon the opaque object S R; from the object they are reflected to the magnifier *o*, from which they proceed, diverging to the screen *p q*, where the object will be painted, and its apparent size increased.

Compound microscopes have been constructed of almost every possible dimension, from a few inches in length to that of twenty feet; but from practical experience it appears evident that, when their magnitude is augmented beyond a certain point, the performance of the instrument is deteriorated, though we suppose the amplifying power of both microscopes the same; indeed, those of the larger description, which have been made to examine objects of considerable dimensions, cannot be considered of any use except for amusement. The reason, however, why the smaller instrument produces a better representation of the object, has not been determined; for in both instruments (mathematically) the proportional errors are the same, but it may be that the errors in the smaller instrument, though existing, are not so divided as to be discoverable to the organ of vision. At present no certain proportion between the length of the body of the instrument and the focus of the object-glass has been determined, except that the body requires to be lengthened when the focal length of the object-glass is increased, to give its maximum effect. The average length of body for different object-glasses is from five to ten inches; for when the rays after once being acted upon are allowed to travel any considerable distance, to form the image in the focus of the eye-piece, they will be so much separated and weakened that the eye-piece will not be able to collect them truly. And it may be further remarked that the power should always be obtained by the object-glass in preference to the eye-piece; and, although it is well known that a flat and more extended field is obtained by the latter, yet when these are procured no distinct idea of the structure of the object is discoverable, and thus the very intention of the microscope is destroyed, which ought to unfold to our perception the nature and functions of bodies too minute for ordinary inspection.

Some time ago an eminent natural philoso-

pher, professor Amici of Modena, constructed a very excellent catoptrical microscope, in which he seems to have avoided the imperfections to which the instruments formerly constructed upon the same principle were liable, and to have combined several advantages which are not possessed by the best dioptrical microscopes now in use. The ingenious inventor has published a minute description of this improved instrument, in a memoir inserted in the eighteenth volume of the Transactions of the Italian Society. The body of this microscope consists of a horizontal brass tube, twelve inches in length, and one inch and one-tenth in diameter. At one end of the tube is placed a concave speculum of metal, whose axis coincides with that of the tube, and whose superficies is elliptical; and so calculated, that of the two foci, the one falls at the distance of two inches and six-tenths, and the other at twelve inches from its centre. A small arm within the tube carries a small plain mirror of metal of an oval form, placed at the distance of one inch and six-tenths from the former, opposite to it in an oblique direction, and supported by an oblique section of a metal cylinder five-tenths of an inch in diameter. The centre of the polished surface of this mirror coincides with the axis of the concave mirror, which is situated at the distance of one inch and five-tenths from the centre of the other.

This plain mirror is so placed that, while it receives the image of the object (which is placed on a moveable object-bearer attached to the pillar below it), by means of a small aperture in the under part of the body of the tube, it throws it towards the concave mirror, in which it may be examined by the eye of the observer, applied to the opposite end of the tube, through a greater or smaller number of magnifying eye-glasses, which may be fitted to it.

The internal diameter of the tube, which regulates that of the large mirror, may be one inch and one-tenth, and the thickness of the surrounding metal about one-twentieth of an inch. Upon this construction, the object to be examined may always be at the distance of half an inch from the edge of the tube, and consequently be very well lighted on every side,—transparent objects from below, by means of a common illuminating mirror, fitted to the pillar, and moveable,—and opaque bodies from above, either by the natural light falling directly in, or by concentrating an artificial light, by means of a convex glass fitted to the object-bearer—or, still better, by means of a pierced mirror of metal, which is fitted to the tube below, over the object, so as to be brought more or less near to it. The large illuminating mirror below should be concave, having a diameter of three inches, and a focal distance of 2·5 at the utmost.

The effects of the two last mentioned mirrors may be reciprocally combined, by means of a common corresponding adaptation,—by receiving and reflecting the rays of light so as to produce the highest degree of intensity of light, and the most perfect illumination of the object on all sides, both as a whole, and in its different parts, an advantage indeed, which may be obtained in dioptrical instruments by similar means.

The inventor considers the proportions above given as best adapted for the convenient use of the instrument, in order to preserve, along with a high degree of effect, and even the highest degree of magnifying power, a moderate distance of the object from the microscope, viz. half an inch, which not only allows the most simple and perfect illumination from above, but also admits of our examining objects of considerable size entire, without separating the parts, and also small animals alive.

A common dioptrical microscope, whose object-glass has a focal distance of six lines, would correspond with this state of the object, and consequently admit of similar advantages, but with a much diminished magnifying power, of about 1500 or 2000 in the area. Professor Amici has accordingly compared the best English microscopes of Adams and Dollond with his own; and, upon a comparative examination of the same objects, he maintains that his instrument shows the object more clearly and distinctly, even when magnified in the same degree. The professor had no opportunity of making experiments with the microscope of De la Barre, and those made at Benedictbeuern by Utzschneider and Fraunhofer; but he thinks himself justified in concluding that his own admits of a far greater degree of magnifying power than the latter, as he perceives that their largest microscope does not magnify the objects above 22,500 times in the area, while his goes the length of 1,000,000. He has also endeavoured to show, by a mathematical calculation, that such a high degree of magnifying power cannot be attained in a dioptrical instrument.

The following, according to Amici, are the advantages of his microscope; 1. The observer has the convenience of being able to examine the object in a horizontal position, while, in those constructed on the dioptrical principle, the object is examined in a vertical position, that is from above. The observer, therefore, may be seated, has no occasion to bend his head, and can examine objects more conveniently, or for a longer time than with a large dioptrical instrument on the common construction. 2. The different degrees of magnifying power can be easily and speedily applied and changed, nothing more being necessary for this purpose than to change the eye-glass, without varying the position or distance of the object, so that it may be examined with great rapidity in all different degrees of magnitude, without the least variation of the points of view; while, in the dioptrical instruments, it is necessary not only to change the object-glass, but also the visual distance, which not only occasions loss of time, but very seldom admits of the object being again seen in the same position, and in the same point of view. 3. As in this new instrument the object always remains in the same position, and is kept constantly at the distance of half an inch from the body of the microscope, it consequently admits of our examining objects immersed in fluids, and animals swimming, and that nearly at an equal depth, and in every degree of magnitude. With dioptrical instruments, on the other hand, this is quite impossible, on account of the

shortness of the focal distance in the highest degrees of magnifying power, as the object-lens must be brought so near the object as almost to come in contact with the fluid. 4. The light may be brought to bear upon all sides and in all directions, even by means of a lamp or taper, as the flame can be brought very near the illuminating mirror, without being troublesome to the observer. 5. As metallic specula do not disperse the light, and consequently produce no colors, the objects appear of their natural color. 6. The diameter of the concave mirror being so large, compared with its focal distance, we may expect so much more distinctness. 7. As the distinctness of the image produced by reflection is greater than that produced by refraction, the degree of magnifying power may be carried much higher.

While speaking of the compound microscope, it may be proper to state that the most valuable object-glasses for this species of instrument are those that are rendered achromatic; as a much larger angle of aperture may thus be obtained than by the ordinary arrangement. These were first constructed at the suggestion and expense of Dr. Goring, by Mr. W. Tully, in the summer of 1824, and more recently in France, by M. Chevalier. The aplanatic of Mr. Tully consists of a concave of Guinard's flint glass placed between two convex lenses of crown and Dutch plate glass. The apertures obtained in these object-glasses are equal to half their focal distances, which are from 0·2 to 1·0 inch focus. By the increase of aperture which is here attainable the penetrating power is augmented, so that the varied markings on objects are rendered visible with these large apertures, which with common object-glasses of the same power are wholly undiscernible. This property of the penetration of a microscope being always as the angle of aperture, was first pointed out by Dr. Goring, and is fully borne out by experiment. In the telescope the penetrating power necessary to observe stars and nebula is dependent on the area of the object-glass or metal, without relation to its focal distance; but in the microscope it is the result of the aperture in proportion to their focal distance. The difficulties that present themselves in correcting the aberrations of these object-glasses, when of short focus, is considerably increased, though their penetrating powers are always improved by a diminution of their focal length. The spherical aberration is greater and more difficult to correct than in telescopes (the convex seldom having sufficient abberration to correct the concave); and, as the rays enter diverging from the object, the calculations of their radii are more abstruse than in a telescope for parallel rays. The curvatures and dimensions of one of Mr. Tully's object-glasses are as follows:—

	Inch.
Sidereal focus of the object-glass	0·933
Total diameter of the lenses	0·55
Clear aperture	0.5

		Inch.	
Radius of	1st surface	0·825	convex
Ditto	2nd	0·525	crown
Radius of	3rd surface	0·5	concave
Ditto	4th	0·5	flint.
Ditto	5th	0·575	convex
Ditto	6th	0·575	Dutch plate.

	Inch.
Specific gravity of crown	2·527
Thickness of ditto	0·15
Specific gravity of flint	3·627
Thickness of ditto	0·164
Specific gravity of Dutch	2·519
Thickness of ditto	0·175

The object-glasses of M. V. Chevalier are constructed on the principles laid down by Euler, and consist of a double and equally convex lens of plate glass cemented to a plano-convex of Guinard's flint. The construction is remarkably simple, the radii of all their surfaces being alike. The measures of one of these achromatics obtained by Mr. Lister are as follows:—

	Inch.
Radii of the isosceles convex	0·66
Radius of the plano-concave flint	0·66
Thickness of the concave at the edge	0·74
Thickness of the convex at the centre	0·72
Diameter of the lenses	0·36

When these object-glasses came first into this country, although achromatic, and two of them were combined, which is a considerable improvement on the single ones, they could not show the test objects, the aperture being cut off by a small stop; but on removing this stop Dr. Goring was enabled to make them effective on most of them.

The combination of three sets of achromatic lenses for an object-glass has recently been executed by professor Amici, who, in order to have the body of the microscope horizontal and object-glasses vertical, introduces a right-angular prism to change the direction of the rays. But the introduction of so many surfaces, viz. fifteen, has a tendency to weaken the outline of the objects. Mr. Dollond has, however, lately combined two triple object-glasses of one inch focus, and about half an inch aperture, which perform extremely well: they can also be used separately. It is necessary for us to remark here that, as the ray after passing through the first aplanatic combination is in a different state to what it is on entering the second, due correction ought to be made when these glasses are intended to be used separately and combined; indeed, in those of short focus, such correction is absolutely requisite; so that, if they are perfect when combined, only one can be so if employed singly. When a triple one and a double one are combined, the performance seems best of all.

If we are desirous of producing an aplanatic object-glass, without using the achromatic combinations above described, that of Mr. Herschel will be found of great value, as it is free from all spherical aberration in the axis. One has been executed of only one-sixth of an inch focus, with an aperture of the one-fifteenth of an inch, which brings out all the test objects and exhibits opaque ones with facility. This combination is made of crown glass.

MIDDLE AGES. That portion of duration is called the middle ages, in the history of Europe, which begins with the final destruction of the Roman empire, and ends with the Reformation; or with the discovery of America; or with the taking of Constantinople; or with the invention of the art of printing: the propriety of selection being regulated by the object of each historian. In general, the middle ages may be said to embrace that space of history in which the feudal system was established down to the most prominent events which led to its overthrow; although its consequences and influence are still observable in the states of Europe. The dark ages mean the first centuries of the middle ages, a name which they certainly deserve; still, however, the destruction of the Roman institutions, by the irruption of barbarous tribes, is often unduly lamented, and the beneficial consequences attending it overlooked. It is certainly to be regretted that acquisitions, which cost mankind ages of labour, were lost in the general wreck, and only regained by the efforts of many successive generations; the flowers of civilization trampled under foot by barbarian warriors; and those nations to which Roman civilization extended, previous to the great Teutonic invasion, thrown back into primæval barbarism.

The feudal system filled Europe with powerful barons, possessing vast landed estates, and commanding the services of numerous armed adherents. Proprietors of the soil, with arms perpetually in their hands, they were too proud to obey any laws but those of honour, which they had themselves enacted, and despised all engaged in peaceful occupations, as ignoble and created to obey. In this state of society the classes, not military, preserved their independence by union, which afforded them mutual protection, enabled them to exercise their callings unmolested, and thereby acquire wealth, which served as a counterpoise to the landed possessions of the barons: this necessity led to the foundation of cities. These small states gradually grew up into great ones; and many citizens acknowledged no superior, except the highest authority of the nation to which they belonged. Strong walls, in conjunction with the valour of the townsmen, secured the freedom of those that dwelt within, and protected them from the tyrants of the land; well ordered civil institutions preserved peace and prosperity within; and both were secured by the wealth acquired by trade and manufacturing industry. The barons endeavoured to retain their hold over the citizens, by establishing themselves within the walls, and expressing an ambition to become chief magistrates of these little commonwealths. In some instances they soon usurped the exclusive power, by flattery and apparent condescension; while in those states that were imperfectly organized, and where the pride of the nobles was excessive, the power and prosperity of the cities rose to such an height, that in Germany and Italy they became formidable even to the emperor; and the people, a third estate, was fully developed in Arragon as early as the twelfth century.

The third estate, the cities, united with the barons in wresting the magna charta from king John of England, in 1215; and their growth in France may be traced to the conduct of Louis Le Gros, and his successors, particularly Philip the Fair, 200 years after him, who deemed it their wisest policy to protect them against the nobility, and thereby increase their own ability of resisting that powerful order. Cities acquired the earliest and the greatest pre-eminence in Germany and Italy: what could not be accomplished by single towns in France and England, was effected by the unions or leagues of several in the great empire; the league of the Lombard cities in Italy; the Hanseatic, Rhenish, and Suabian leagues in Germany, appeared at the same time as great and formidable powers. Under the protection of such associations, and sheltered by embattled walls, all arts and trades, and every species of civilization, made rapid progress. Many important inventions originated amongst the citizens of those free states, or were suggested by their active, commercial, and manufacturing spirit.

It is remarkable that the ancient and modern republics were equally exposed to the overwhelming power of ambitious individuals, so dangerous to all free communities: the oppressed portion of the citizens were again compelled to have recourse to the same means of relief that had originally given rise to the parent city, and generally bound themselves to each other by some formal contract, for the better protection of their rights. From such associations, usually formed amongst those of the same trade, and having for their object, next to security from external enemies the maintenance of internal order in those stormy periods, arose corporations or guilds, which were under the direction of a master. At first none were admissible into these bodies who had not served an apprenticeship to some particular trade: at a later period admission was purchased by individuals who wished to share in the advantages of the association; this was frequently the case in the 14th century, when the corporations obtained almost exclusive possession of the government of the cities; the corporations taught the nobles that, as they contributed nothing to the prosperity of the place, by their industry, it did not become them to govern it. As long as the nobility continued in the cities, after this exclusion from power, they preserved themselves in close connexion, and with those in the country formed confederacies against the corporate power. Associations, the only means of security against the disorders of the time, became so universal, that every where persons of the same trade or profession were closely united, and had certain laws and regulations amongst themselves: even knowledge, in the universities that were established, was obliged to do homage to the spirit of the age, and the liberal arts themselves, in the latter part of the middle ages, were fettered by the restraints of corporate rules.

The most remarkable and characteristic institution of the middle ages was chivalry. The profession of the nobles was war; no one of their order, who had not served as a knight, could bear a lance or command a troop of cavalry; and the service of years, as an attendant or

squire, was necessary to entitle even one of the highest order to be dubbed a knight; but squire, knight, and baron, were all inspired with the same romantic spirit of honour, gallantry, and devotion. The religious zeal of the middle ages induced hundreds of youths, of both sexes, in the bloom of life, to shut themselves up within the gloomy walls of a cloister, or retire to wild deserts, and there pass their lives in penitence and prayer; thousands of bare-footed pilgrims annually travelled across sea and land, to pray and do penance at the tomb of the Saviour; hundreds of thousands flocked thither also, with the cross in one hand and the sword in the other, to free the Holy Land from the pollution of infidels. The artful and ambitious, taking advantage of this enthusiastic spirit, established by its means intolerance, the destruction of the Jews and heretics, the splendour of the papal court, and the all-embracing system of the hierarchy. In opposition to the secular, which rested on the feudal system, and was sustained only by armies of vassals, the pope formed, from archbishops, bishops, priests, still more from the generals of religious orders, provincials, abbots, and monks, an immense army, invincible through its power over the conscience, and through the spiritual weapons which belonged to it and to its head.

All the kings of the West acknowledged the pope to be the living vicegerent of Christ: many were his vassals, many tributary; almost all obedient and subject to him, and in a short time victims of a vain resistance.

Arnold of Brescia, the Waldenses, Wickliffe and Hus, and their followers, endeavoured to overthrow the corrupt hierarchy by reminding the people of the simplicity and poverty of the primitive church; they found, unhappily, that their contemporaries were not yet ripe for freedom of mind, and their noble efforts, consequently, in a great measure failed. Mendicant orders of friars, and the institution of the inquisition, obstructed the dawning light of the 13th century: excommunications and interdicts held all Christendom in terror; till at length, with the diffusion of a free spirit of investigation, the establishment of more rational order amongst monarchies, and the cooling of religious enthusiasm, the veil of darkness was drawn aside, the close of the middle ages approached, and Luther arose, to free the mind from bondage.

Poetry was revived, and much cultivated, in those ages. The chivalrous knights of those times were passing their lives in battle, in romantic deeds, in festive pomps, and religious exercises. Poetry first appeared amongst the knights during the 12th century, in the southern provinces of France; there chivalry first sprang up, and with it shot forth the first sparks of modern poesy. The founders of modern poetry were provincial Troubadours, who sung at the court of Brerengarious of Toulouse: soon after these the French trouveres, and the German minnesingers, poured out their lays in their mother tongue: the Italians, mistrusting their own, sang in the Provençal; and the English, from a similar apprehension, in the French tongue. The Italians are indebted for their high poetic fame to Dante, who brought the Tuscan dialect into honour, and enabled the minstrels to establish a national poetry. In Spain the Catalonian poetry was the same as the Provençal, but the Castilian and Portuguese partook more of the Arabians. The modern epic is distinguished from the poetic narration of the ancients, by its majestic tone, its indefinite longing for something more elevated than the realities of earth, which have conferred upon it the title of romantic.

The subjects of the romantic epics are limited to three cycles or collections of stories: the first of these is the truly German, Nibelungen, the stories of Attila, and the heroes of the time of the general migration of nations; next to these rank the equally old tales of the British king Arthur, his round table, and the Sangraal, which, according to the old Welsh fables, was sung in France, and afterwards in Germany, and to which Tristan, the enchanter Merlyn, and others belong: to these a third collection is to be added, originally French, of Charlemagne and his peers, of Roland, the enchanter Malegys, and the four sons of Harymon: as to the famous romance of Amadis de Gaul, this belongs peculiarly to the Spanish, and not to one of the three collections here mentioned.

Historic events of ancient and modern times, particularly the exploits of Alexander the Great, the Crusades, Scripture History, and the incidents of the ancient epics of Homer and Virgil, furnished subjects for poetical works towards the close of the middle ages. Poetry gradually declined in the two last centuries of those ages. In the thirteenth century there was not a story in the three cycles, before mentioned, that was not eagerly sung by many poets, and upwards of 1400 songs, written by 136 poets of this century, are contained in the Manesse collection alone: the voice of the minstrel was almost wholly silent in Germany, France, and Spain, in the fourteenth century; but Italy boasted of her Petrarch and Boccacio, and England of her Chaucer: after the 14th century, hardly a single poet appeared amongst the knights. Epic poetry was replaced by romances in prose; and the lyric poetry of France and Germany fell into the hands of the Master-singers, who, by a studied observance of rules, preserved its formal existence: so did it continue until the 15th century, when all were attentive only to the great events that were in preparation, and actuated by a spirit of thinking, were far removed from that free flow of feeling which had given birth to the poetry of the past time. Ariosto, the Italian Homer, flourished at the close of the middle ages, when the early spirit of poetry lived only in remembrance. A new national poetry was introduced in England by Shakspeare, and in Spain by Cervantes.

Architecture and painting attained the highest excellence: the noblest buildings of the ages that had long preceded, appeared only as the ornamented forms of habitations which necessity had created, and can at most be called fine buildings; but the Gothic or pointed architecture of the middle ages was founded on a great conception; this conception, which appears in the union of the grandeur of great masses with the

finished delicacy of parts, was the sylvan temple of the first inhabitants, was the representation of the world. Painting and other arts came from Greece, in the 14th and 15th centuries, into the Western kingdoms, and attained their greatest splendour in the middle ages, upon the Lower Rhine and in Italy.

Scientific learning at that period was almost wholly neglected. Charlemagne encouraged the growth of science, and endeavoured to instruct the people, but his exertions hardly produced any effect beyond his life; and even some centuries after his reign the German tribes considered no knowledge of advantage, but that of managing the lance and steed. In those days the most distinguished could scarcely read or write, and whoever obtained further learning, particularly in mathematics or national science, exposed himself to the hazard of being burned as a sorcerer. The learning of the ancients was preserved through those ages, and handed down to us by the monks, who were educated in the monastic schools, and whose natural occupation was literature. They copied old writers, particularly the fathers of the church, registered passing events in chronicles, and succeeding ages are indebted to them for the preservation of the valuable remains of antiquity, for the materials and stimulants to new improvements.

In the history of the Eastern empire the introduction of Mohammedanism and the Arabic literature is analogous to the middle ages of the West, in marking epochs in their history. In the 11th century a partial taste for literature was given by the monks, and afterwards by the arts and industry that prevailed in the cities: learning was encouraged by Henry II. of England, by the Hohenstaufen, St. Louis, the Alphonsos, and other intellectual princes: and from these times, the age of Lanfranc, Abelard, and John of Salisbury, the middle ages produced distinguished men, whom the coldness of their contemporaries, in the cause of science, only urged to a more ardent pursuit of it.

Dialectics, from whence the church dogmatics were formed, were much cultivated; a disputatious spirit awoke, that was not calmed until the theses of Luther in Wirtemberg shed a new light upon science. The Reformation was the cause and origin of high intellectual exertion and freedom of thought, and materially assisted the striving after freedom of conscience, which originated some centuries before, with the flight of the Greek scholars from Constantinople; and both were aided in their operation by the invention of printing, which had been encouraged by the princes of Italy, and had shone forth in Germany, in the brotherhood of Deventer, in Wessel, Erasmus, Celtes, Reuchlin, and others: with the appearance of these men, with the rise of the sun of the new day, the romantic twilight of the middle ages faded.

MIDAS, in fabulous history, the son of Gordius by the goddess Cybele, a king of Phrygia.

Midas, in zoology, the ear shell, the smooth ovato-oblong buccinum, with an oblong and very narrow mouth. It consists of six volutions, but the lower one alone makes up almost the whole shell.

MIDDLEBURG, a considerable and well-built town of the Netherlands, on the island of Walcherin, forty-six miles south-west of Rotterdam.

MIDDLEBURY is a post town, and the capital of Addison county, states of Vermont, United States, standing on both sides of Otter Creek; eleven miles south-east of Vergennes, thirty-one south of Burlington, thirty-two north of Rutland, and fifty-one south-west of Montpelier.

MIDDLEBOROUGH, a post town of Plymouth county, Massachusetts; is ten miles west of Plymouth, and thirty-nine south of Boston, United States. Population 4400. This is a large township, and contains a rolling and slitting mill, a shovel manufactory, two forges, two furnaces, two cotton manufactories, a town-house, an academy, and eight houses of public worship, three for Congregationalists, and five for Baptists.

MIDDLESEX, an inland county, containing the capital of England, obviously derives its name from its situation, being inhabited by the Middle Saxons. Prior to the Roman invasion it was inhabited by the Trinobantes. After the complete subjugation of the island this district was made part of the division named Flavia Cæsariensis. Middlesex is situated towards the south-east part of the island, and bounded on the south by Surrey, from which it is divided by an imaginary line down the middle of the river Thames; on the east by Essex, from which it is divided by a similar line drawn along the middle of the river Lea; on the west by Buckinghamshire, from which it is divided by a supposed line drawn down the middle of the Coln; and on the north by Hertfordshire, from which county it is divided by an irregular line of parish boundaries. This county is of a very irregular shape; but if its shape were reduced to a parallelogram, of equal superficies, the medium length and width would be about twenty miles by fourteen; and consequently it contains 280 square miles, or 179,200 acres. It is in the province of Canterbury, and diocese of London. It is divided into Edmonton hundred, Elthorne hundred, Ossulston hundred, Finsbury division, Gore hundred, Holborn division, Isleworth hundred, Kensington division, Spelthorn hundred, Tower division, the city of London within the walls, and the city and liberties of Westminster. These are subdivided into 230 parishes, precincts, and extra-parochial places, whereof 122 are within the city of London, ten in the city and liberties of Westminster, and ninety-eight in the rest of the county. Here are also two cities, and seven market-towns.

Of the climate of this county, Mr. Middleton, in his Agricultural Report, observes that the temperature of the atmosphere, except, perhaps, so far as the influence of London fires extend, is nearly the same through the whole county; there being no situation so much elevated as to produce the cold and thin air that we find in mountainous countries. In general it is healthy, owing to the greater part of the soil being naturally dry; and the more moist situations, being well-drained, are consequently free from those unhealthy vapours which usually arise from stagnant waters. The fires of London, in which are

consumed upwards of 800,000 chaldrons of coals annually, have a sensible effect on the climate in its neighbourhood, by drying and warming the atmospherical air; which, being thus rarefied by heat, constantly passes upwards, and makes way for a fresh supply to come in from every side. The most stationary winds are from the south-west and north-east. All others are variable and unsettled. Those from the south-west are supposed to blow six-twelfths of the year, and those from the north-east about five-twelfths. The varying winds blow from all the other points of the compass about the other one-twelfth. The winds seldom blow with so much force in this district as to shake the grain out of the ripe ears of the standing corn. The greatest falls of rain come from a few points west of the south, and are of the longest continuance when the wind has passed through the west to the south. In the spring months the damp on low ground is sometimes congealed by cold, when there is no such appearance on the hills; and thereby some of the young shoots of the most tender shrubs and plants are destroyed in the former situation, when no injury happens to those in the latter. This phenomenon probably happens less frequently in Middlesex than in such counties as abound more with hill and dale. The extremes of heat and cold are often very great. The thermometer has been known to rise as high as 84°, and to fall as low as 6° below 0°: these extremes, however, fortunately, never last long. Dr. Fordyce says that the heat of the air in London is very variable, seldom remaining equal for many days; and every year differing entirely from the preceding ones, not only in heat, but also in moisture and rains. Sometimes the winter is severely cold, with frost from November till May. In the month of February, 1814, the writer of this sketch, with many thousands besides, walked along the river Thames, from Blackfriars Bridge to nearly London Bridge, so firmly rivetted was the ice at that time. A second or third 'Thames Fair' was held on the ice, which lasted many days. This, however, is a very unusual circumstance. Sometimes, however, the water in this county is not frozen for more than ten or twelve days. Most commonly there is a little frost in November and December; but otherwise these months are usually very foggy and moist. The principal frost generally is in January; February is commonly a mild, open, and moist month; March is generally cold and dry. The summer months vary as much: sometimes there are three months very warm; sometimes not more than a week; the latter half of July is commonly the hottest. In August heavy rains often fall, especially in the last half of the month. The most common summer heat is from 65° to 75°. The most common winter heat, when it freezes, is between 20° and 30°; the most frequent, when it does not freeze, between 40° and 50°. These observations respecting the climate should be understood to refer more particularly to the cities of London and Westminster.

The soil of this county varies extremely, from the operation of the elements, from its being more or less manured, and from cultivation; so that the surface of all the lands assumes more or less the appearance of loam. Accordingly a surface of perfect sand, clean gravel, or pure clay, is not now to be found in any part of the county. The following account of the soil and fertility of Middlesex, extracted from Norden's Speculum Britanniæ (written in the reign of Queen Elizabeth), may amuse the reader who wishes to compare ancient with modern times:—'The soil of Middlesex is excellent, fat, and fertile, and full of profite; it yeeldeth corne and graine not onlie in abundance, but most excellent good wheate, especially about Heston, which place may be called Granarium tritici regalis, for the singularitie of the corne. The vaine of this especiall corne seemeth to extend from Heston to Harrow-on-the-Hill, between which, as in the midway, is Perivale, more truely Purivale, &c., &c. Yet doth not this so fruitfull soyle yeeld comforte to the wayfaring man in the winter time, by reason of the claieish nature, which, after it hath tasted the autumne showers, waxeth both dyrtie and deep; but unto the countrie swaine it is a sweet and pleasant garden, in regard to his hope of future profite, for

The deep and dirtie loathsome soyle
Yields golden graine to painful toyle.

The industrious and painful husbandman will refuse a pallace to droyle in these golden puddles.' 'The wheat of Heston was so famous that Queen Elizabeth, as it is reported, had the most part of her provisions from that place, for manchet for her Highnesse's own diet.' The summits of most of the highest hills in the county consist of sand and gravel, though frequently intermixed with loam. Hampstead Hill consists of eight or ten feet of yellow iron-stained sand, with some loam or rounded flints, on a pure white sand of many more feet. The surface is covered with furze, except where the ground is dug. Loamy sand, or turnip and barley land, includes all that portion of country lying between the road leading from Hounslow to Colnbrook on the north, and the river Thames on the south, containing in depth from one foot to three (though for the most part from eighteen inches to two feet), on the gravel of small flints, six, eight, or ten feet in thickness; and under the gravel is a leaden-colored tenacious earth, used by the tile-makers, of great depth. On the east side of the county, the whole way from Tottenham to Enfield Wash, the superstratum is of the same light nature, of from six inches to two feet in depth, on a gravel of small flints, which can only be dug, for the repairing of roads, to the depth of from two feet to five, owing to its then putting on the appearance of a quicksand, so filled with water as to prevent all deeper digging. Sandy loam will include all the land between the Colnbrook and Uxbridge roads, on the west side of Hanwell and Hounslow, of from eighteen inches to upwards of five feet in depth, on six or eight feet of the gravel of flints, on a subsoil of impervious leadened-colored earth. Of this description is the south side of the parish of Harefield, and the parishes of Twickenham, Isleworth, Ealing, Chiswick (the soil of which is from a strong to a tender or sandy loam, and from a rich and fertile to a white and sharp sand and gravel), Kensington, Fulham (consisting of a light, black, and fertile soil), Brompton, and Chelsea. Strong

loam: all the land from Ryslip and Ickenham on the west, to Greenford, Apperton, and Harrow, on the east, is composed of strong loam. The land about South Mimms is also of this kind. The level between Islington, Hampstead, and Hornsey, is a strong but very productive loam. Loamy clay, which is generally called clay, as is the leaden-colored impervious subsoil before repeatedly mentioned, constitutes the north aspect of a hill between Uxbridge Common and Harefield, the land north-west of Ryslip, the greater part of Hanger Hill, a wood near the east end of Hillington Heath, and the land between the river Brent and Hampstead, on the Hendon road. The meadows on the north-west side of Hendon church, towards Page Street, are of nearly the like kind; much of this parish, indeed, is of a clayey nature, yet there are patches of sand, and more of gravel. From Nightingale Hall by Colney Hatch to Whetstone the land is of a loamy clay, mixed with pebbles of flints; and from Potter's Bar, for about two miles towards South Mimms, the soil is the same. The north side of Highwood Hill has a thin skin of loamy clay, on a subsoil of yellow clay; and in many of these places the subsoil is a yellow clay; but all the varieties abound with rounded flints. Peat: The moors near the river Coln, the whole distance from Rickmansworth to Staines, consists principally of peat on a substratum of the gravel of flints, which occasionally in almost every place about here shows itself on the surface. Peat has also been found on the borders of the river Lea, and in the Isle of Dogs. This isle which contains nearly 1000 acres, most or all of the land on the flat borders of the rivers Lea and Coln, some inconsiderable quantity of land on the side of the Brent, the small islands in the river Thames, and many pieces of land situated in the various nooks and windings of that river, come under the description of marsh land. The surface of this county, though 'gently waving,' can no where make pretensions to what is called the picturesque.

No ragged woody mountains nor craggy ivy-bound rocks here present themselves to intercept the traveller on his way, or to captivate the fancy of the painter; but the more chaste, beautiful, and ornamented scenes may be found in many parts of the county. The inequalities of the surface which we meet with in this district contribute to health, ornament, and beauty. Here are not many dingy heaths nor sombre-colored woods to offend the sight in the gay season of May; but shady groves, diversified plantations, and meandering rivers. Numerous villas, ornamented grounds, lawns, and medallions of beautifully flowering shrubs almost every where present themselves to the view of the traveller; which, together with the great number of lofty spires and gay carriages, cannot fail to remind him of being in the vicinity of a metropolis which may very justly be called the Centre of Commerce, Wealth, and Fashion. The north border of the county is high ground; and, by the shelter it affords, adds considerably to the fruitfulness of the other parts. The principal hills are Highwood and Hendon, the hill at Barnet, another between that place and Elstree, also Brockley Hill; which, together with the Highgate and Hampstead hills, are the highest in the county. Their summits are nearly of the same level, which is about 400 feet above the level of the tide. Mr. Middleton is of opinion that Hampstead is a little higher than Highgate; and as it is considerably higher than Harrow, and most other ground in the county, he estimates its apparent height in the following manner: viz. as near as can be judged by the eye, it is a small matter higher than the top of St. Paul's cross; therefore, suppose St. Paul's church-yard to be above the tide thirty feet; the height of St. Paul's is said to be 340 feet; and this writer thinks Hampstead is higher by about thirty feet: which several dimensions make Hampstead to be above the level of the tide 400 feet, as above stated. From Norwood to Cowley, for a length of six miles on the Uxbridge Canal, the surface is eighty-five feet above low-water mark at Brentford Bridge; at Uxbridge it is ninety-six feet; and in the meadows near Harefield it is 107 feet above the said mark. All the land to the south of the road, passing from Brentford through Hounslow to Longford, is so nearly level as to have no more than a proper drainage, and much the greater part of it is less than ten feet above the surface of the river Thames at Staines Bridge, and not more than from three to five feet above the level of the rivulets flowing through this district. From Staines, through Ashford and Hanworth Common to Twickenham, a distance of seven miles and a half, is a perfect level, and generally from ten to twenty feet above the surface of the river Thames. Round the one mile-stone on the Kingsland Road, the surface is lowered from four to ten feet (average five), by the earth having been dug and manufactured into bricks, over an extent of more than 1,000 acres. The recent works on Highgate Hill, now forming one of the noblest roads in the kingdom, and called the Highgate Tunnel, or Archway, have lowered the hill many yards, though they have no sensible effect on the general face of this part of the county.

Middlesex is abundantly supplied with very excellent water. The Thames, the prince of rivers, divides this country from Surrey. The largest ships in the service of the East India Company can safely come up this river, to the edge of the county at Blackwall. It is navigable for West India ships to London Bridge, and for barges all along the southern border of the county. This river is rendered famous by the port of London in every commercial part of the world. The tide flows for about twenty-three miles up the Thames, along the side of the county. This river, from Oxford to Maidenhead, falls about twenty-four feet every ten miles; from Maidenhead to Chertsey Bridge nineteen feet every ten miles; from Chertsey Bridge to Mortlake thirteen feet every ten miles; and thence to London one foot per mile; and the fall gradually diminishes till it is lost as the river approaches the sea. To this noble and capacious river the county of Middlesex, and indeed the kingdom in general, is much indebted for the assistance it affords, not only as an easy and cheap conveyance of the products of our island, but also as being the means of bringing to our

very doors the various productions of the whole habitable globe; serving at the reflux of the tide as a useful drain to carry off the filth and superfluous water of the capital and surrounding country: then, by the wonderful chemical operations of nature, returning to us with its excellent purified stream,

Though deep, yet clear; though gentle, yet not dull;
Strong without rage; without o'erflowing, full!

The river Lea forms the eastern border of the county. The Brent, the Coln, and the small river Carn, are also rivers of this county; and the Regent's Canal and Park are now amongst its beautiful geographical features.

From the Brent is derived the name of the county town, Brentford. This is indeed called the county town, and here the elections for the county take place; but it is a low, miserable place, with scarcely a good house in it. The Serpentine River in Hyde Park is artificial, made about the year 1730. Spring water is to be obtained in many parts of the county at a small expense of sinking, and there are several mineral springs. But little can be said of the natural produce of this county. It owes almost every thing valuable of this nature to cultivation. There are no mines in the county; nor have any metallic strata been discovered here.

Middlesex returns fourteen members to parliament: viz. two for the county, four for the city of London, two for the city of Westminster, two for the borough of Finsbury, two for Mary-le-bone, and two for the Tower Hamlets. See LONDON 510

The eminent persons that have been born in this county are almost too numerous even for a bare list of names. For the sake of uniformity, however, such a list shall be here attempted:—Michael Alford. Jacob Allestrey. Edward Alleyn. Launcelot Andrews. Francis Anthony. John Anthony. John Argall. John Arnold. William Arnell. Dr. T. Arne. George Ashton. Albricius, a physician and philosopher of the eleventh century. George Ashwell. Francis Bacon. John Bacon. Henry Baker. Joshua Barnes. Dr. Isaac Barrow. Thomas Birch. William Bowyer. Thomas Broughton. Sir Thomas Browne. James Butler. Richard Owen Cambridge. William Camden. Sir Thomas Chaloner. Geoffry Chaucer. Charles Churchill. Colley Cibber. Susanna Maria Cibber. Dr. John Colet. Anthony Ashley Cooper, earl of Shaftesbury. Samuel Cooper. Abraham Cowley. William Cowper, dean of Durham. John Davenport. Thomas Day. Dr. John Dee. John Dennis. Dr. Philip Doddridge. John Donne. John Ellis. Thomas Farnaby. Thomas Flaxman. Dr. W. Fleetwood. Dr. T. Franklin. John Gale. Richard Gough. John Gaunt. Thomas Gray. Dr. Maurice Green. Sir Thomas Gresham. Dr. Edmund Halley. Robert Harley, earl of Oxford. John Hampden. Dr. William Hawes. James Heath. John Henderson. John Heywood. Eliza Heywood. Joseph Highmore. Aaron Hill. Bishop Hoadly. Dr. J. Hoadly. William Hogarth. Thomas Holcroft. Thomas Hollis. John Hoole. John Hoppner. Bishop Horsley. Dr. John Jebb. Soame Jenyns. Ingulphus. Inigo Jones. Sir W. Jones. Dr. J. Jortin. J. Keeple. Anne Killigrew. Dr. William King. Thomas King. Dr. S. Knight. J. Leland. Wm. Lowth. Isaac Madox. Michael Maittaire. Henry Mill. John Milton. Sir Thomas More. George Morland. Thomas Mortimer. John Motley. Robert Nelson. George North, M. A. Anne Oldfield. John Palmer, the comedian. Samuel Paterson, the bibliographer. William Penn, the Quaker, of immortal memory. Catherine Phillips. Alexander Pope. Percival Pott, F. R. S. James Quin, the comedian. Isaac Reed. Dr. William Rowley. William Seward. James Shirley. Stephen Skinner. Rev. Dr. Thomas Smith. Edmund Smith. Dr. Daniel Charles Solander. Edmund Spenser. P. D. Stanhope, earl of Chesterfield. George Stepney. John Stowe. John Strype. James Stuart, called Athenian Stuart. Sir William Temple. Bonnel Thornton. Andrew Tooke. Thomas Twining. Richard Verstegan, antiquary, &c. George Vertue. Dr. John Ward. Thomas Wentworth. Bulstrode Whitelock. John Wilkes. Henry Woodward, comedian. Daniel Wray. All the above, and doubtless many more, many of them equally deserving of notice, were natives of London. The following were born, most probably, in some other part of the county:—Henry Aldrich. Eustace Andrews. Sir Arthur Aston. Allen Bathurst. Thomas à Becket. Henry Bennet. T. Betterton. Sir Thomas Pope Blount. Anthony Collins. Martin Folkes. Dr. John Hough, bishop of Worcester. John Howard, of immortal memory. Sir William Killegrew. Thomas Killegrew Dr. H. Killegrew. Dr. William King. Dr. R. Mead. James Nares. Lacy Ryan. Dr. Robert South. Dr. Brook Taylor. Dr. Joseph Toms. Edward Vernon. Paul Whitehead.

The manufactures, trade, and commerce of Middlesex embrace every species of traffic, art, and occupation, that the whole kingdom itself can boast. See, however, the description of LONDON.

MIDDLESEX, a county of Massachusetts, North America, is bounded north by New Hampshire, east by Essex county, south-east by Norfolk county, and west by Worcester county. Population 52,789. Chief towns Charlestown, Cambridge, and Concord.

MIDDLESEX, county of Connecticut, is bounded north by Hartford county, east by New London county, south by Long Island Sound, and west by New Haven county. Population 20,723. Chief town, Middletown.

MIDDLESEX, county of New Jersey, is bounded north by Essex county, east by Staten Island and Raritan Bay, south-east by Monmouth county, south-west by Burlington county, and north-west by Somerset county. Population 20,381. Chief towns New Brunswick, and Amboy.

MIDDLESEX, county of the east part of Virginia; bounded N. N. E. by the Rappahannock, east by Chesapeake Bay, south and south-west by Mathews, Gloucester, and King and Queen counties, and north-west by Caroline county. Population 4414. Slaves 2476. Chief town Urbanna.

MIDDLETON (Dr. Conyers), a celebrated English divine, the son of a clergyman in Yorkshire, was born at Richmond in 1683. He distinguished himself, while fellow of Trinity College, Cambridge, by his controversy with Dr. Bentley his master, relating to some mercenary conduct of the latter in that station. He afterwards had a controversy with the whole body of physicians, on the dignity of the medical profession; concerning which he published De Medicorum apud veteres Romanos De gentium Conditione Dissertatio; qua, contra viros Celeberrimos Jacobum Sponium et Richardum Meadium, servilem atque ignobilem eam fuisse, ostenditur. Hitherto he had stood well with his clerical brethren; but he drew their resentment on him in 1729, by writing A Letter from Rome, showing an exact conformity between popery and paganism, &c.; which appeared dangerous to the cause of miracles in general. In 1741 came out his great work, The History of the Life of M. Tullius Cicero, 2 vols. 4to.; which is indeed a fine performance. In 1748 he published A Free Enquiry into the Miraculous Powers which are supposed to have subsisted in the Christian Church from the earliest ages, through several successive centuries. He was now attacked from all quarters; but, before he took any notice of his antagonists, he supplied them with another subject in An Examination of the Lord Bishop of London's Discourses concerning the use and extent of Prophecy, &c. He was in 1723 chosen principal librarian of the public library at Cambridge; and, if he rose not to dignities in the church, he was in easy circumstances, which enabled him to assert a dignity of mind often forgotten in the career of preferment. He died in 1750, at Hildersham in Cambridgeshire, an estate of his own purchasing; and in 1752 all his works, except the life of Cicero, were collected in 4 vols. 4to.

MIDDLETON (Sir Hugh), a public-spirited goldsmith and citizen of London, born at Denbigh; to whom the inhabitants of that great city are indebted for the benefit of the New River, which he began February 20th, 1608, after the scheme had been given up as impracticable, by uniting two streams in Middlesex and Hertfordshire; and at last happily accomplished in 1613, but at the expense of his whole fortune. King James I., who greatly approved and patronised the plan, and agreed to pay half the expense, rewarded his public spirit by creating him a knight, and afterwards a baronet. Sir Hugh died in the reign of Charles I. and left a share in the New River to the poor of the Goldsmith's Company.

MIDDLETON (Thomas Fanshaw), D.D. F.R.S., the first bishop of Calcutta, was the son of the rector of Kedleston, Derbyshire, and born in 1769. He was educated at Christ's Hospital, and proceeded upon a school exhibition to Pembroke Hall, Cambridge, where he took his first degree in 1792. He took orders this year as curate of Gainsborough in Lincolnshire, where he wrote a periodical paper called The Country Spectator. Attracting, in 1794, the attention of Dr. Pretyman, archdeacon of Lincoln, he employed him as a tutor to his sons, and obtained for him the rectory of Tansore, to which, in 1802, was added in commendam that of Little and Castle Bytham. The late Rev. R. G. Robinson LL.B., vicar of Harborne, &c., was the friend to whom the bishop's father was indebted for the opportunity of placing his son at Christ's Hospital. This circumstance the bishop never forgot; for Mr. R. was among the first to hear of any success of the bishop's, and Mr. R.'s son was pressed very much by him to accompany him to India as his chaplain. The following is an extract of a letter to Mr. R. from the bishop:—

Peterboro', May 29, 1795.

'Mr. Pretyman has presented me to the rectory of Tansore, in Northamptonshire, and I am now at Petersborough for institution. I give you almost the earliest intelligence of this affair, because I am aware that this, and every other success which may attend me, must ultimately be ascribed to you.'

He took his doctor's degree in 1808; and the same year appeared his work on the Greek Article, the doctrine of which he has most ably illustrated. In 1809 he was promoted to a stall in the diocese of Lincoln, the vicarage of St. Pancras, Middlesex, and the rectory of Puttenham, Herts: in 1812 he was made archdeacon of Huntingdon. When government resolved to establish a bishop in India, Dr. Middleton was selected for that station, and, being consecrated at Lambeth in May, arrived at Calcutta in November, 1814. In 1820 he laid the foundation stone of Calcutta church, and a school for the education of the Christian poor: a missionary college was soon after established. Dr. Middleton died in the midst of these labors of a fever, July 8th, 1822. His sermons and charges have been collected by Dr. Bonney into 1 vol. 8vo., with a biographical memoir.

MIDDLETOWN, a town of the United States, the capital of Middlesex county, Connecticut, is situated on the west bank of Connecticut River, thirty-four miles above its mouth. It is a pleasant and flourishing town, and has considerable trade and manufactures. It contains a court-house, a jail, four churches for Congregationalists, Episcopalians, Independents, and Baptists. It has, besides, a large woollen manufactory. The river is navigable to this place for all vessels drawing ten feet of water; and in 1816 the quantity of shipping that belonged to the port amounted to 19,499 tons. Two miles from the city is a lead mine. Population 2014; and, including the township, 5382. Twenty-five miles N. N. E. of New Haven. 2. A township of the United States, in Monmouth county. New Jersey, south of Raritan Bay. Population 3849. 3. A flourishing town of the United States, in Dauphin county, Pennsylvania, situated on the north-west side of Swatara Creek, a little above its junction with the Susquehannah. It carries on a considerable trade in wheat and flour. Ninety-two miles west by north of Philadelphia. 4. A township of the United States, in Delaware county, New York. Population 2318. 5. A township of Bucks county, Pennsylvania. Population 1663. 6. A township of Delaware county, Pennsylvania. Population 948.—It is also

the name of various inconsiderable townships in the United States.

MIDDLEWICH, or MIDDLEWICK, a town of Cheshire, 166 miles north-west of London. It stands near the conflux of the Croke and Dan, below the junction of the Wheelock and Dan, where are two salt-water springs, from which are made great quantities of salt, the brine being said to be so strong as to produce a full fourth part salt. It is an ancient borough, governed by burgesses, and its parish extends into many adjacent townships. It has a spacious church, and a market on Tuesday; and fairs on St. James's day, July 25th, and Holy Thursday. It has an inland navigation of above 500 miles, by the Mersey. See MERSEY. It lies twenty-four miles east of Chester.

MIDHURST, a town of Sussex, which has been represented in parliament ever since the 4th of Edward II. It is a neat small town, on a hill surrounded with others, having the river Arun at the bottom; and is a borough by prescription, governed by a bailiff, chosen annually by a jury at a court-leet of the lord of the manor. It has a market on Thursday; fairs on March 21st, and the Thursday after. It is 11 miles north by east of Chester, and 50 west by south of London. It sends one member to parliament.

MIDIAN, or MADIAN, in ancient geography, a town on the south side of Arabia Petræa; so called from a son of Abraham by Keturah.

MIDIAN, a town near the Arnon and Æoplis, in ruins in Jerome's time.

MIDIANITES, the people of Midian. With their daughters the Israelites committed fornication and idolatry. A branch of the Midianites dwelt on the Arabian Gulf, and were called Kenites; some of whom turned proselytes, and dwelt with the Israelites in the land of Canaan.

MIDNAPORE, a district of Bengal, once a portion of Jellasore, and of the province of Orissa, but transferred to Bengal about the year 1706. It contains 6000 square miles and 1,500,000 inhabitants. For a long period in the hands of the Afghauns it has a greater number of Mahometans than most other districts. It was ceded to the East India Company by the nabob Cossim Aly Khan. It contains a great number of small forts, one of which was some time since discovered in the middle of a forest, containing twenty pieces of cannon, in an unserviceable state. These old forts and the forests still serve as a refuge for robbers. Midnapore, though not so fertile as Burdwan, produces abundance of sugar, grain, tobacco, cotton and indigo. Its chief manufacture is sannas, a fine calico. Its chief towns are Midnapore, Jellasore, Piply, and Narraingur; its rivers the Cassia and Subunreeka.

MIDNAPORE, the capital of the above mentioned district, formerly possessed a brick fort, surrounded by a ditch. This is now converted into a jail. It is the station of a judge, collector, &c., and has a cantonment for two battalions of infantry. Long. 87° 25′ E., lat. 22° 25′ N.

MID'RIFF, *n. s.* Sax. mıðhpıꝼe; Goth. *midrif*, *mid* and *hrife*, the belly. The diaphragm. See the extract from Quincy.

Whereat he inly raged, and, as they talked,
Smote him into the *midriff* with a stone
That beat out life. *Milton's Paradise Lost.*

In the gullet, where it perforateth the *midriff*, the carneous fibres of that muscular part are inflected. *Ray.*

The *midriff* divides the trunk of the body into two cavities; the thorax and abdomen: it is composed of two muscles; the first and superior of these arises from the sternum, and the ends of the last ribs on each side. The second, and inferior muscle, comes from the vertebræ of the loins by two productions, of which that on the right side comes from the first, second, and third vertebræ of the loins: that on the left side is somewhat shorter; and both these productions join and make the lower part of the *midriff*. *Quincy.*

MIDWIFERY.

MID'WIFE, *n. s.* } MID'WIFERY. } From the Goth. *mit*, *met*, wise, cunning, and rif (*huif*, a woman's hood) wife: Scot. *cannie wife*. Skinner and Junius confound the first syllable with the Sax. mıð, meed, a reward. But the French retain the old northern idea of the word in their *sage femme*, and the Dutch in their *vroed-moeder*, wise mother or woman. Strictly, a woman who assists the human female in child-birth: in the modern acceptation midwifery includes the medical treatment, by either sex, of all the symptoms and consequences of pregnancy, and of the child or children produced, while suckling. See below.

And it came to pass, when she was in hard labour, that the *midwife* said unto her, Fear not; thou shalt have this son also. *Gen.* xxxv. 17.

Without a *midwife* these their throes sustain,
And, bowing, bring their issue forth with pain.
Sandys.

When man doth die, our body, as the womb,
And as a *midwife*, death directs it home. *Donne.*

There was never any thing propounded for publick good that did not meet with opposition; arising from the humour of such as would have nothing brought into the world but by their own *midwifery*.
Child's Discourse on Trade.

There saw I how the secret felon wrought,
And treason labouring in the traitor's thought,
And *midwife* time the ripened plot to murder brought.
Dryden.

I had as clear a notion of the relation of brothers between them, as if I had all the skill of a *midwife*.
Locke.

So hasty fruits, and too ambitious flowers,
Scorning the *midwifery* of ripening showers,
In spight of frosts, spring forth the' unwilling earth.
Stepney.

But no man, sure! e'er left his house
And saddled Ball with thoughts so wild,
To bring a *midwife* to his spouse,
Before he knew she was with child. *Prior.*

History of Midwifery.

Midwifery, in the present and extended import of the term, includes not only the assistance directly afforded to women in the act of child-birth, but the relief of the diseases connected with their sexual system, as well as those of their infants during the period of lactation.

We shall endeavour to present to our readers a brief, yet a connected sketch, of this branch of medical science; dwelling very slightly on the early periods of its history, when the notions of the ancients were so erroneous, and their practices so absurd, as scarcely to reward the trouble of investigation.

The practice of midwifery, or rather the bestowment of help on parturient women, was almost co-existent with the human species. 'There must have been a time,' says Dr. Denman, 'when the rude but well-meant endeavours of one friend to relieve another in distress ceased, and application was made to those who were supposed to have more information or greater skill. This would properly be the origin of the art.'

From all the passages of Scripture where midwives are mentioned, it is plain that women were the only practitioners of this art among the Hebrews and Egyptians. It is equally certain that the Greeks and the Romans confided this most important branch of medicine to women. Rachel, the wife of Jacob, and Thamar, who was delivered of twins, were assisted by midwives. Pharaoh, king of Egypt, commanded the midwives to destroy all the male children of the Hebrew women; but they nobly disobeyed. Phanarete, the mother of Socrates, was a midwife; and Plato explains the functions, and regulates the duties undertaken by these females. He remarks that at Athens they had the right of proposing and making marriages. Hippocrates, Aristotle, Galen, and Ætius, allude to midwives in their works; and Aspasia, who was probably celebrated amongst the women of this order, is not unfrequently cited by Ætius.

These instances are interesting, inasmuch as they prove that a distinct class of females was employed to render assistance in labor. In these early ages every circumstance would favor the health and energy of the species; and where the difficulties of parturition were trivial, not arising from malconformation or a debilitated system, a little longer time, and the encouragement of the midwife, associated perhaps with manual help, more apparent than real, would be amply sufficient to overcome every obstacle. In other instances, as we cannot suppose they enjoyed an entire exemption from pelvic deformity and extensive hæmorrhage, more especially at Athens and Rome, where luxury and voluptuous dissipation were widely prevalent, such assistance as the imperfect state of their knowledge on this subject enabled them to bestow could not have prevented a most painful mortality amongst parturient women. It ought, however, to be remembered, that the warmth of the climate would exert a genial influence, and very much facilitate the progress of labor. To this circumstance we may perhaps fairly attribute a great portion of that success, which to us, at this period, appears to have exceeded any reasonable expectation.

Hippocrates, who practised medicine in Greece 460 years before the Christian era, is styled by some authors the father of midwifery as well as of physic. It is needless to dwell on the unbounded veneration with which his name has been regarded by succeeding ages. His works will ever excite the highest admiration, as carrying with them indubitable proofs of profound and laborious research. His sagacity and experience fully entitle him to our praise; and yet, by only glancing at his obstetric views, we shall afford our readers ample means to estimate the very little progress which the science had then made. To female diseases, not immediately associated with parturition, he evidently paid much attention; there was little or no difficulty in the way of personal observation, and his opinions and method of treatment are to this day, in some measure, the objects of enquiry.

In midwifery, on the contrary, he had no such opportunities; his information was not gained at the bedside of the patient. The precise character of the circumstances to be remedied, and the 'ratio medendi' of the means proposed, came to him through the medium of persons incapable of forming a correct opinion, and of making a just report. It is not wonderful, therefore, that we now smile at his notions, and hold in little estimation his uncouth and curious remedies. He is, notwithstanding, a splendid example of ancient medical knowledge and practice.

Hippocrates was acquainted with no other kind of natural labor than that in which the head presents. Here, if the progress was slow and difficult, he recommended sternutatories; and, if these failed, the patient was to be held by the shoulders, and gently shaken at intervals till her pains expelled the child. He represents presentations of the feet as generally fatal; and in these, as well as where the arm, leg, or side presents, he recommends returning them as soon as possible into the uterus, and to bring down the head. If from any untoward circumstance, as the death of the child, or the swelling of its body, its delivery could not be effected, he directs that it shall be brought away piece-meal. His injunctions relative to the management of the placenta are replete with danger. Its immediate extraction is recommended; and pulling at the funis, in various ways, is the principal method of procedure. From this period till after the commencement of the Christian era midwifery made no progress. Celsus, who flourished in the reign of the emperor Tiberius, A. D. 37, although an ardent admirer and a close copyist of Hippocrates, threw some new light on parturition. He recommended, in the case of a dead child, the introduction of the hand; and the delivery by the feet in cases where the arm presented; and was of course aware of the error of Hippocrates in attaching such fatal consequences to footling cases. He also recommends the dilatation of the os uteri, from which, however, little benefit and much injury may often arise. This improved method of delivery did not meet with all the credit and support which it deserved; for Galen, who lived A. D. 131, about 600 years after Hippocrates, condemned it as decidedly as his great predecessor had done.

Pliny too, who lived under Vespasian and Titus, accords with Galen; and, although not a physician himself, attests the opinions of the physicians of his time. He asserts the difficulty attendant on labor where the feet present, denominates it preternatural, and adds, that children coming into the world in this manner were called agrippa, that is to say, born with much difficulty.

This opposition to delivery by the feet was not easily overcome; for, although men of reputation approved and recommended it, we find that, as late as the middle of the seventeenth century, Riverius publicly condemned footling labor; and Mauriceau remarks, in the first edition of his book printed in 1664, that many authors were still of opinion that, in such cases, it would be better to turn, and bring down the head of the child. After having, however, observed that it is difficult, if not impossible, to execute this, he concludes, 'it is much better to extract the child by its feet, when they present, than to run the hazard of doing worse by turning it.'

The advantages of this first great improvement in obstetric science are so apparent, and the principle on which it proceeds is so simple,—so superior to the laborious, and in many cases insuperably difficult and dangerous practice of bringing down the head, that we are filled with surprise at the hostility opposed to its adoption. It is impossible to place in a clearer light, the ignorance and irresponsibility of the writers and practitioners of midwifery at this period; they propose almost as a universal remedy a procedure which can rarely be adopted with safety, and the employment of which must have been attended, in the majority of instances, with the most calamitous results. Turning a child, by the most skilful practitioner, and in the most favorable circumstances, is a truly undesirable occurrence; we can, therefore, easily conceive its consequences in such a rude and undigested condition of the principles and practice of the art.

It would seem no useful purpose to dwell on the series of writers who succeeded Celsus; they were, for the most part, devoted followers of Hippocrates; and, where this was not the case, they were little more than transcribers of each other. Amongst the number may be mentioned Moschion, in the reign of Nero; Rufus, Ephesius, Galen, in the reign of the emperor Adrian; Oribasius, and Paulus Ægineta, who closes the list of ancient Greek writers on medicine.

Le Clerc, in whose History of Physic much curious and very interesting matter will be found, places Paulus at the end of the fourth or the beginning of the fifth century; at or before which period the western Roman empire had been overturned by the Goths and Vandals. Le Clerc supposes that the celebrity of Alexandria, for centuries the chief seat of philosophy and science, though now past the meridian of its splendor, had induced him to prosecute his studies in that city; to have done which, according to Ammianus Marcellinus, in the time of the emperor Valens, was a sufficient pretence for any one to commence the practice of physic.

Soon afterwards the library of Alexandria was burned, its scientific treasures were dispersed, and its learned men driven into exile by the ruthless hand of Mahometan intolerance. Thus terminated the splendor of the last of the ancient schools. But the Saracens were happily destined in their turn to carry forward philosophical and intellectual enquiries; and in Arabia astronomy, geometry, and medicine, were cultivated with great zeal and no small success. Nor can we forget that to them we are indebted for the use of numerical characters, and that their physicians first presented to the world an account of the small-pox. Yet our notices of the medical writers of this school must necessarily be brief; although, as they devoted themselves in some degree to midwifery, our history would be imperfect were we not to present to our readers some short abstract of their labors.

Serapion treats, at some length, of the diseases of pregnant women, with the method of cure.

Rhazes follows in the same course, and advises the membranes to be ruptured by the nail, or by a small knife, when, by their roughness, they impede the labor.

Avicenna, who lived at Ispahan about the year 1000, possessed amazing celebrity, and his writings maintained their fame till the restoration of learning. It was he who gave the first description of the forceps, or an instrument to be employed in difficult parturition, with the double purpose of saving the life both of the mother and the child. In all preternatural cases Avicenna adheres to the erroneous practice of reducing the head into the natural position; but where this is impossible he enjoins delivery by the feet, and pronounces it the safest of the preternatural presentations.

Albucasis, the last Arabian writer to be mentioned here, lived in the eleventh century at Cynopolis, on the Caspian Sea; and according to Dr. Smellie, to whom we are indebted for some valuable facts introduced in this sketch, 'is the same person who was also known by the name of Alsaharavius, at least so it appears from an Arabian manuscript now in the Bodleian library.' Albucasis has merely followed his predecessors, annexing a more particular description of the instruments then used in midwifery.

Having thus briefly traced the progress of medical science, so far as midwifery is concerned, from the earliest ages, we must remark that about this period (the twelfth century) the study of physic began to decline in the east. We have already seen that at the destruction of the Alexandrian library the dispersion of the learned in different countries was productive of good. By these events, in themselves so disastrous, science was diffused over many parts of the world, which might otherwise have remained in darkness and error.

After the conquest of Rome by Odoacer, the eastern part of this vast empire survived for many centuries. Constantinople, its capital, was distinguished not only by its splendor and magnificence, but by its cultivation of the arts. Men, devoted to science, here found an asylum, till its final subjugation by the Turkish arms,

under Mahomet the Second. But the religion and manners of the Turks were most unfavorable to literature; they were led to circumscribe all philosophy and knowledge within the narrow limits of their own intolerant and fanatical faith. It is therefore naturally to be supposed that individuals devoted to literary pursuits would seek elsewhere the tranquillity which the barbarity of their conquerors would necessarily deny. So that the wisdom of Providence in this, as in other instances, educed extensive good for mankind from devastation and war.

Many of these individuals would doubtless repair to the schools which had been established in Italy since the eighth century, from which western Europe first derived their knowledge; and amongst these Padua was especially famous for the cultivation of medicine. It must also be remembered that the darkness of the middle ages was now passing away; that the dawn of that day had appeared, which, in its full splendor, was to enlighten the whole of Europe, and to create a period distinguished by historians as the 'revival of letters.' The minds of men, too, were arising, perhaps for ever, from the ignorance and degradation in which they had been so long lost; and the art of printing, now fully established, had removed every serious impediment to the attainment and distribution of human learning. The accumulated stores of the ancients were exposed to observation and enquiry throughout Europe; and the Greek MSS. preserved after the destruction of Alexandria, and which had been already translated into the Syriac, Persian, and Indian languages, were brought from Constantinople by the learned Greeks, after the taking of that city in the year 1453. The universities of Paris and Montpelier succeeded those of Italy, and continued, till the eighteenth century, to attract not only the students of medicine, but those also who were desirous of improvement in general literature and science.

But it is now time to direct the attention of our readers nearer home, and to trace before them the progress which medicine, and more especially midwifery, were destined to make in England. It would be very easy to show that our own country has afforded no pleasing exception to that slow and very gradual attainment of knowledge which has marked the early history of all nations. The wars in which the Britons were so frequently engaged were little conducive to scientific attainments; and perhaps no individual before Roger Bacon, who flourished in the thirteenth century, ought to be considered as at all learned. This enquiry is however foreign from our purpose. We shall, therefore, at once remark that the establishment of the College of Physicians in London, by the charter of king Henry VIII. in 1518, may be considered almost the first event directly favorable to the improvement of medicine. Linacre, a man, according to Dr. Freind, of a bright genius and clear understanding, as well as unusual knowledge in different parts of learning, was its first president, and remained so till his death. He published a translation in Latin of different parts of Galen, of which it has been remarked that, from the exactness and propriety of the style, any one might have supposed it was written in a classical age. Dr. Freind in eulogising Linacre, more especially for the foundation of the college, observes, 'The wisdom of such an institution speaks for itself. His scheme without doubt was not only to create a good understanding and unanimity among his own profession (which of itself was an excellent thought), but to make them more useful to the public; and he imagined that by separating them from the vulgar empirics, and setting them upon such a reputable foot of distinction, there would always arise a spirit of emulation among men liberally educated, which would animate them in pursuing their enquiries into the nature of diseases, and the methods of cure for the benefit of mankind. And perhaps no founder ever had the good fortune to have his designs succeed more to his wish; this society having constantly produced one set of men after another, who have done both credit and service to their country by their practice and by their writings.' In proof of this statement we may refer to the discovery of the circulation of the blood by Harvey, to the labors of Glisson on irritability, to those of Willis on the brain and the nervous system, and to the great improvement of our knowledge of the glandular and lymphatic systems by Joliffe, Wharton, and Needham, and more especially in later times by Dr. W. Hunter.

Dr. Denman laments that Linacre did not print his works in English, in which language they would have been generally read, have afforded immediate instruction, stood as good examples, and taught a proper method of writing. He attributes to this defect of Linacre the continuance of English medical writers in their former style; and for many years little real progress in knowledge was made, or any titles heard of but those of Urinals, Judgment of Urynes, Anatomy of Urynes, Treasures of Health, Mirroures of Health, &c. In 1540 was published the first book on the subject of midwifery in England, entitled The Byrth of Mankynde, otherwise named The Woman's Book, by Thomas Raynold, physician; it underwent a second edition by Thomas Ray a printer, whose name is not much known. It was illustrated with prints, and was held in high estimation. Dr. Raynold informs his readers that this book had been translated from the original Latin some years before by a studious and learned clerk; who having performed the task incorrectly, he, Dr. Raynold, had been at great pains to revise and enlarge it in another translation. Its original author, according to Dr. Smellie, was Eucharius Rhodion, whose book was in great esteem all over Germany; and in the year 1532, being translated into Latin and other languages, from the original high Dutch, became universally the Woman's Book over all Europe, and was introduced into England, when it was translated by this Dr. Raynold.

In the year 1578 the celebrated Harvey was born at Folkstone in Kent, and, having completed his studies at Cambridge, he went to Padua, where he graduated in 1602. In 1603 he published his treatise on generation; and afterwards,

engaging in the practice of midwifery, he published his Exercitatio de partu. Sydenham also soon afterwards noticed the diseases incident to childbed women, and those of young children.

It is now proper to remark that more general attention began to be bestowed on midwifery; its great importance, as a part of the healing art, was fully appreciated; and the example of Harvey, who had personally engaged in its practice, was followed by the calling in of men practitioners in all difficult cases. Astruc assures us that the epoch of the employment of men midwives goes no farther back than the first lying in of madame De la Valière, mistress of Louis XIV., in 1663. She sent for Julian Clement, a surgeon of high reputation. He was conducted with great secresy to the house, the lady's face was covered with a hood, and the king is supposed to have been concealed in the curtains. The same surgeon was employed in the subsequent labors of this lady, and, as he was very successful, men midwives afterwards came into repute; the name of accoucheur being given to them.

It is then the fact that obstetric science made but little progress in Europe till the seventeenth century. The very reverse of this appears to be the case in China. In that empire, according to the latest accounts, both physic and surgery are still in a state of the utmost degradation; but, for some hundred years, the art of midwifery has been practised by a set of men destined to the purpose by order of government. These men, who hold in society the same rank which lithotomists formerly did in this country, are called in whenever a woman has been a certain number of hours in labor, and employ a mechanical contrivance for completing the delivery, without injury to the infant. A certain number of these individuals is allotted to each district of a certain population. It is said that the Chinese government was led to make this provision in consequence of many women dying undelivered, and that, in the majority of cases, the obstacles might have been removed by very simple mechanical expedients. These facts were communicated by a gentleman who resided upwards of twenty years as surgeon to the British factory at Canton.

About 1634 the works of Ambrose Paré, the first modern who had made any considerable improvement in midwifery, were given to the world. The reputation of Raynold's book, which had maintained its standing for nearly a century, was now destroyed. Paré expressly orders, in all preternatural cases, that the child shall be turned, and brought away by the feet, thus at once deviating from the erroneous practice of the ancients, which had in a greater or less degree prevailed until his day. At this time surgery was more cultivated in Paris than in any part of the world; and the obstetric department of the Hotel Dieu was erected, into which poor women with child, destitute of the necessaries of life, were admitted. In the year 1668 Mauriceau published a Treatise on Midwifery, which exceeded every thing before made public on that subject. He gives a very full account of all the different kinds of labor; and the book having been translated into English, by one of the sons of the celebrated Dr. Chamberlen, it continued in great estimation for many years. Dr. Chamberlen and his three sons were contemporary with Mauriceau, and for some time they preserved to themselves the exclusive advantage arising from the knowledge of the forceps and lever. Chapman, however, made public a description of this instrument in 1773; although, previously to this period, instruments, differing from those described by the Arabian writers, had been used in Germany, France, and other places. The success attendant on the practice of the Chamberlens induced a too frequent use of the forceps; which gave rise to publications, impugning the propriety of interfering with the efforts of nature, and of any endeavours to hasten the birth of the child.

Dr. Maubray, the first public teacher of midwifery in this country, coincided in these views and in a book entitled The Female Physician, or the whole Art of new improved Midwifery, he violently declaims against the use of instruments. The names of Dionis and Deventer may be next mentioned, both of whom concurred in deprecating the use of instruments in midwifery. Deventer was originally a watchmaker. He entertained the opinion that the wrong positions of the os internum and fundus uteri are the principal causes of lingering, difficult, and dangerous labors.

In 1727 appeared Dr. Simson's work, entitled The System of the Womb, a production of considerable ingenuity, but not of much use in practice. Chapman, who was the second public teacher of midwifery in London, published a Treatise on its Improvement in 1773. His description of the forceps appeared in the third volume of the Edinburgh Medical Essays. In the year 1734 Dr. Hody published A Collection of Cases in Midwifery, written by Mr. William Giffard. He gave a plate representing the forceps; and was, it is generally believed, the first who asserted that the placenta might be attached over the os uteri.

About this time lived Sir Richard Manningham, who devoted himself to the practice of midwifery, and established a small hospital for the reception of parturient women only, which was the first thing of the kind in the British dominions.

It is, perhaps, scarcely necessary to pursue this narrative any farther. The names of Smellie, Dr. William Hunter, Denman, and of Levnet, in France, are familiar to all professional readers, and a perusal of their works cannot fail to excite a high admiration of their talents and industry. To use the words of Dr. Denman, 'The English might be said from this time (1740) to have been in full possession of the subject; all the books written in the neighbouring countries being translated, public lectures given, and hospitals established, for the further improvement of the art · and, as all the books printed since that time may readily be procured, every one has an opportunity of forming his own opinion of their respective merits.'

A variety of circumstances thus concurred to forward the progress of the obstetric art; and it may with truth be affirmed that, although its cultivation was so long deferred, it has attained a degree of certainty and perfection which places it at least in an equal, if not a superior rank, with any other department of medicine. We are well aware that many other distinguished individuals might be mentioned, who have contributed very largely to the general store of obstetric knowledge; but some of them are still living; and we much prefer an allusion to their individual contributions in the subsequent part of this treatise, bringing forward their opinions on those subjects which they have either discovered, illustrated, or confirmed.

We shall comprise the whole of our remarks on midwifery in four divisions:—

I. We shall first explain the obstetric properties of the pelvis, carefully noticing those deviations which may obstruct parturition. Under this head we shall treat on the healthy and morbid circumstances of menstruation.

II. The second division will include the description of the gravid uterus, with the doctrines of conception, sterility, and the signs and diseases of pregnancy.

III. In the third part of the treatise we shall dwell very fully on labor, in all its varieties, and on the various kinds of flooding.

IV. And, to conclude, we shall treat as briefly as possible, consistently with practical purposes, on the diseases which occur soon after delivery.

PART I.

EXPLANATION OF THE PELVIS.

1. It is not our intention to enter at large into the anatomical description of the bones, joints, and ligaments of the pelvis: we shall consider them only so far as they are essentially connected with parturition and its consequences; the minuter details having been already dwelt upon in an earlier part of this work.

2. We find in the fœtus and young subject, that the pelvis is composed of eight bones, viz. two ossa ilia, two ossa pubis, two ossa ischia. the sacrum, and the coccyx. Till the age of puberty these bones remain distinct, and this arrangement obviously affords mobility, and allows the bones to adapt themselves to pressure. In difficult parturition therefore, and especially in breech presentations, labor may be thus somewhat facilitated. In the adult, on the contrary, from the consolidation of the bony structure, we can enumerate only four bones: the ossa innominata, or side bones of the pelvis; the sacrum fitted in behind, and serving as a basis for the support of the spine; and the os coccygis subjoined to the end of the sacrum.

3. *Ossa innominata.*—These bones form the principal part of the bulk of the pelvis, yet they are not very essentially connected with parturition. Bearing in mind that each os innominatum is made up of three distinct bones, the ilium, the os pubis, and the ischium, it is easy to understand the construction of the anterior curve of the outlet denominated the arch of the pubes. The anterior part of the ossa pubis forms its top, the processes of the ischia and pubes its sides, and the tuberosity of each ischium its base. Each os innominatum may also be divided into the body and wing, and it is by their junction with each other that an angle or edge is formed, which is known by the appellation of the brim of the pelvis.

4. *Sacrum* is a bone of considerable size, triangular in its shape, and curved, its convexity being posterior, its concavity in front, this latter part being denominated by accoucheurs the hollow of the sacrum. At the basis of this triangular bone there is a middle projection, which, in connexion with the body of the last lumbar vertebra, forms what is so frequently mentioned in midwifery, the promontory of the sacrum.

5. *Os coccygis.*—This bone possesses a considerable degree of interest to the accoucheur. It is usually described as consisting of one piece only. This, however, is not correct, it being in reality made up of several, not unfrequently connected together by cartilage, hence acquiring a certain degree of flexibility, and in consequence a slight power of adaptation during the passage of the head of the child. In a few instances this bone is anchylosed with the sacrum, and in consequence is shortened and turned inwards, so as to diminish the advantages which are obtained by its receding when the child comes into the world. Denman says, that the impediment occasioned thereby at the time of labor may be, and usually is, overcome by the force with which the head of the child is propelled, and the os coccygis is again separated from the sacrum, with a noise loud enough to be distinctly heard. He had known more than one circumstance of this kind. Burns observes that by falls or blows it may be luxated; and if this be not discovered, and the bone replaced, suppuration occurs about the rectum, and the bone is discharged. The insertion of the coccygei muscles of a portion of the levatores ani, and of slips of the sacro-sciatic ligaments into the sides of the coccyx, keep it steady and prevent any lateral motion.

6. *Ligaments.*—The obturatores, and the external and internal sacro-ischiatic ligaments, alone possess obstetric importance, and they have been fully described in another place.

7. *Joints.*—The hip, the lumbar, the sacro-iliac joints, the sacro-coccygeal joints, and the symphyses pubis, may all be enumerated as belonging to the pelvis; but the last three claim from us peculiar attention.

8. *Sacro-coccygeal joint.*—This joint, as we have already observed, is moveable, enlarging, perhaps posteriorly, the outlet of the pelvis, to the extent of an inch. Its construction is similar to the other joints of the body. It has articulating surfaces invested with cartilage and covered with synovial membrane. A capsular ligament connects the two bones arising all round from the extremity of the sacrum, and inserted all round into the base of the coccyx; this completing the articulation. This joint is occasionally the subject of disease.

9. Its *anchylosis* we have already mentioned, which Dr. Blundell (see his Lectures, reported in the Lancet) thinks of very rare occurrence; and he believes it still more rarely produces any serious obstruction to parturition. We have, however, seen one case in which the birth of the child was very much retarded by the encroachment of this bone on the capacity of the inferior outlet of the pelvis. It much more frequently happens, says Dr. Blundell, that instead of anchylosis there is a rigidity of the parts. A woman may be forty years of age before she is married, and perhaps has a child at forty-one; her health being vigorous, her flesh firm, her fibre rigid and unyielding. Now here a rigidity of the sacro-coccygeal joint, with a rigidity of all the adjacent parts, may prove a very formidable obstacle to labor, requiring the most able and judicious management. There can be no doubt, and the occurrence is admitted and provided for by Dr. Blundell, that in a case of this kind the perforation may be required. It more frequently happens, however, that the obstruction yields to powerful uterine efforts, and that no further injury ensues than a painful degree of tenderness, produced by inflammation about the joint. Such was the result, in the instance we have mentioned, where the lady for some months was compelled to resort to a contrivance when sitting, by which she avoided the possibility of pressure on the part.

10. In Dr. Denman's admirable work on Midwifery cases of the disruption of the sacro-coccygeal joint are mentioned. It is evident their treatment must be conducted on the general principles of surgery; and care must be taken that in their re-union the coccyx does not encroach on the capacity of the pelvis.

11. It is scarcely necessary to state that inflammation of these joints will require the employment of the same means which are resorted to in inflammation of other parts of the body; such as leeches, cupping, fomentation, and a regimen of the antiphlogistic kind, suited to the strength of the patient.

12. In scrofulous individuals the treatment must be modified. Sea air, sea bathing, and generous diet, being invariably productive of the most benefit.

13. *Symphysis pubis.*—This joint has engrossed a large share of obstetric attention, and has ever been thought of great importance. It does not vary in its structure from other joints; it unites the ossa innominata in front, the ends of which are invested with cartilage, connected together by an interarticular portion of fibrous substance. The principal strength of this joint depends on its capsular ligament, the fibres of which are far more numerous on the outer than on the inner part, an arrangement wisely intended to prevent any narrowing of the antro-posterior diameter of the pelvis, in which direction contraction or deformity is most frequently found.

14. The symphysis pubis is occasionally the subject of acute inflammation, which goes on to the suppurative stage: this may arise spontaneously or from injury done to the joint; but it is more frequently associated with gestation. The pain and heat about the part, its tenderness when pressed, and above all the exacerbation of suffering on the slightest motion of the joint, cannot fail to lead us to the seat of disease. It is here manifestly desirable to put a period to the malady in its earliest stage, and to prevent the formation of matter.

15. General and local blood-letting, purgatives, diaphoretics, and above all rest, cannot be too strictly enjoined. If, notwithstanding the adoption of these measures, suppuration should ensue, it will be easily ascertained. In some cases the general disturbance of system may be so great, that the patient may sink before the evacuation of matter: in others, who are more robust, the ligament may yield to absorption, and the pus may thus make its escape; it will however be the duty of the practitioner, if the irritation be alarming, to anticipate this giving way of the ligament, and, by opening the joint, to procure for its contents an early vent.

16. *Sacro-iliac joints.*—These are susceptible of inflammatory action, and sometimes, though very rarely, of suppuration. Mr. Mansfield Clarke, in his very able work on the diseases of women accompanied with discharge, mentions relaxation of these joints as not of infrequent occurrence. Pain in the back, and an incapability of standing for half a minute unless supported on each side, are the diagnostic symptoms. Time is here the principal remedy, although considerable relief may be obtained from the application of a well-adjusted bandage. It is worthy of remark that the same arrangement of ligamentous fibres occurs here as in the symphysis pubis, the greater portion being found on the outer side of the joint: a provision intended no doubt to prevent any impediment to the passage of the child.

Of the Separation of the Bones of the Pelvis.

17. Great difference of opinion has existed on this point. It is a fact that, in many mammiferous animals, immediately previous to labor, a relaxation of ligaments, producing a separation of the joints, does occur. Ruysch and Harvey, judging from their own observations, were convinced that a similar separation almost invariably takes place in the human female. Dr. Denman was inclined to believe that the degrees of separation of the junctions of the bones of the pelvis may be very different, and that when it proceeds beyond a certain degree it is to be considered as morbid. Smellie ventures to assert, from experience and observation, that this separation is by no means a usual symptom, though sometimes it may happen, in which case the patient suffers great pain, and continues lame in those parts for a considerable time after delivery. Burns considers the separation as no advantage, but a serious evil; and in cases of deformed pelvis, when we should naturally look for its operation, did it really exist, we do not observe it taking place.

18. It is well known, he says, to every practitioner, that owing to the distension of the muscles during pregnancy, very considerable pain is sometimes felt at the insertion of the rectus muscle into the pubes, and it is also known, that sometimes, in consequence of pregnancy,

the parts about the pelvis, and especially the bladder and the urethra, and even the whole vulva, may become very irritable. This tender state may be communicated to the symphysis, or some irritation less in degree than that already mentioned may exist, which, in particular cases, seems to extend to the articulation, producing either an increased effusion of interstitial fluid in the intermediate cartilage, and thus loosening the firm adhesion of the bones; or a tenderness and sensibility of the part, rendering motion painful. In either case exertion may produce a separation, and certainly in some cases has done so. The separation is always attended with inconvenience, and often with danger, especially when it occurs during parturition; for abscess may take place, and the patient sink under hectic fever; or inflammation may be communicated to the peritonæum, and the patient die in great pain.

19. For ourselves we are not inclined to believe that any such invariable relaxation of the joints of the pelvis, as would materially facilitate the progress of difficult labor, forms any part of the parturient process; and we are the more inclined to this opinion from the fact that, when any separation has occurred sufficient to produce this result, it has been much more than compensated by increased suffering at the time, and by a painfully prolonged inability to walk afterwards.

Of the Pelvis, considered in relation to the practice of Midwifery.

20. Having thus described the various bones, ligaments, and joints, of which the bony case of the pelvis is made up, we shall now point out the obstetric properties which attach to the pelvis as to a whole; and, in doing so, our remarks will refer to what may be denominated a standard pelvis, or that which is most frequently found, when the skeleton is well formed.

21. The pelvis of the human species, which is stronger in proportion to its size than in any quadruped, may be considered as an arch, supporting the weight of the superincumbent body. Its position is such that a line passing from the third lumbar vertebra will fall upon the superior edge of the symphysis pubis: the cavity of the pelvis being projected so far backwards that the ossa pubis principally sustains the enlarged uterus in advanced pregnancy. Hence we see the reason of that weakness and pain which during this state is so frequently referred to the junction of these bones.

22. It is perhaps worthy of remark, even in so condensed a treatise as the present, that the powers and properties of the pelvis depend much on its position. Dr. Denman observes that, in those animals which possess the greatest share of strength, the position of the pelvis is nearly perpendicular, and the two apertures of the cavity nearly horizontal, as may be seen in the elephant. In those which are distinguished by their speed or agility the position of the pelvis is nearly horizontal, and the two apertures nearly perpendicular, as may be seen in the stag. In mixed animals, or those in which strength and speed are united, the position of the pelvis is neither horizontal nor perpendicular, but inclined, so as to partake, by different degrees of inclination, of the advantages of either position, as may be seen in the horse and ass.

23. Accoucheurs usually divide the pelvis into two regions, the one lying above, the other below the brim, the former being the false, the latter the true pelvis. Of that region which is lying above the brim it will be sufficient to observe, that anteriorly it is wide open, being bounded posteriorly by the lumbar vertebræ, and laterally by the iliac fossæ. Its breadth, from the anterior superior spine of one ilium to another, is usually eight or nine inches, and its depth from three to four. It is evident that if the abdominal parietes are relaxed by the recumbent position, and the elevation of the knees and shoulders, we shall be able to examine the contents of this region satisfactorily, and ascertain pretty correctly any morbid circumstances connected with the pelvic viscera. The true pelvis, which as will readily be conceived is of great importance in the practice of midwifery, has been divided into three parts, the brim, the outlet, and the intermediate cavity; or supposing the whole of the true pelvis to form a kind of canal, whose entrance and outlet are somewhat narrower than the middle, it has been distinguished into the superior strait, the inferior strait, and an excavation.

24. The brim is generally of an oval figure, the long measure being from side to side, and the short diameter from before backward. The average measurement of the short diameter is four inches, five inches from side to side, and five and one-eighth, or five and one-fourth, for the oblique diameter, which is described by a line stretching from the back of the acetabula to the sacro-iliac synchondroses.

25. The brim varies in its make, being in some circular, in others more oval, in some small, in others large, but in general it is of an elliptical form, the regularity of the oval being broken by the promontory of the sacrum. The thorough comprehension of these simple facts will exert a very powerful influence on the management of cases where there is any deviation from the natural progress of parturition. In an ordinary labor, when the vertex of the child presents, we find, in the commencement of the process, that the face is lying towards one side of the pelvis, and the occiput towards the other; and thus, as the long axis of the head of the child corresponds with the long diameter of the brim of the pelvis, we find that it rapidly descends.

26. If, however, this state of things be reversed, and the head of the child be so placed that its face, instead of lying laterally, is situated in front, it is very evident that difficulty must arise, as the long axis of the head is directly opposed to the long axis of the brim; and if the head be large and the pelvis small, or if labor has proceeded so far that the head is wedged in its situation, we may be compelled to use the perforator.

27. In presentations of the feet, if the pelvis should be small and the head large, the child may be lost, and the soft parts of the mother materially injured, by want of attention to these

facts. Now, in these cases, if, instead of any violent efforts at extraction, the practitioner were adroitly to introduce his hand, and turn the face of the child to the one side of the pelvis, so as to make the long measure of the head correspond with the long measure of the brim, the progress of the labor would be facilitated, and the difficulty overcome.

28. It is also worthy of remark that, when we introduce the hand into the uterus, a proceeding never to be adopted without absolute necessity, we should carry it forward, when near the brim, by the side of the aperture, because there we find most room.

29. In the dimensions of the inferior aperture, or outlet, the proportions are reversed; the narrowest part being from side to side. This however, it must be recollected, is entirely owing to the retreat of the coccyx, in consequence of the pressure it sustains from the child's head. From side to side the diameter is four, and, from before backwards, five inches. The form of the inferior aperture is very irregular, consisting, according to Dr. Blundell, to whose very valuable and comprehensive lectures, published in the Lancet, we are much indebted, of three large scallops, one upon either side, and one in front, of vast obstetric interest, known under the name of the arch of the pubes. If, however, we examine a pelvis, with the ligaments still in connexion, the shape of the outlet is quadrangular. It is here necessary to dwell for a moment, as it is important in practice, on the difference between the long axis of the brim, which is from side to side, and that of the outlet, which is from before backward.

30. The head of a child enters the pelvis with the face to one side , and the occiput to the other; before it emerges a change in its situation occurs, and the face is thrown into the hollow of the sacrum, while the occiput is found under the arch of the pubes. The reason of this procedure is plain : the long axis of the head is thereby made to correspond with the long axis of the outlet, and in crural presentations it is very necessary to attend to this point of anatomy; for if at the brim there be great difficulty, when the axes are in opposition at the outlet, we shall find an equal obstacle if the face be situated towards the pubes instead of in the hollow of the sacrum.

31. We cannot better impress this fact on the minds of our readers than by the statement that the cavity of the pelvis is incurvated, and that, in consequence of this incurvation, a straight line will not pass through its centre. The axis of the brim is downward and backward; that of the outlet is downward and forward; and the line of motion of the child's head must of course correspond to the axis of that part of the pelvis in which it is situated.

32. In the cavity of the pelvis we must especially notice the hollow of the sacrum, as the facility or difficulty of parturition very much depends upon it. It serves as a receptacle, making room for whatever part of the child may be descending, in presentations of the vertex, of the face, and of the breech.

33. The depth of the pelvis is a point of consequence, more especially in estimating the progress of labor. We find at the symphysis pubis it does not exceed an inch and a half, or at most two inches, posteriorly from the base of the sacrum to the point of the os coccygis; when under pressure it is about four times as deep as in front; and laterally the depth of the inferior extremities of the ischia is about four inches. Bearing these facts in mind we shall not always allow ourselves to imagine, because we can readily feel the child's head in the front of the pelvis, that its birth is instantly to take place; but, remembering the intermediate depth of the pelvis laterally, and its very much greater depth posteriorly, we shall be fully aware that difficulty may be experienced from incarceration.

34. In making examinations it is well to avail ourselves of the shallowness of the pelvis in front, which affords the utmost facility for carrying the fingers considerably beyond the brim. We may remark here that the arch of the pubes in ordinary labor, when the head is at the outlet, serves the very important purpose of allowing the occiput sufficient space to lie forth in front, by which it relieves the pressure, and facilitates the passage of the face through the hollow of the sacrum.

35. The upper edge of the ossa pubis is slightly everted, thus preventing any impediment to the entrance of the head of the child into the cavity of the pelvis; and, at its lower edge, there is some degree of divergence; an arrangement by which the advancing motion of the head is very much facilitated.

36. We cannot better conclude our observations on the general properties of the female pelvis than by pointing out its bearing on the spine, and by a description of those marks which distinguish it from the pelvis of the male.

37. By the plane of the brim, says Dr. Blundell, is meant an imaginary surface, closing in the superior aperture of the pelvis, and forming a sort of flooring there. The pelvis unites with the spine in such a bearing that the plane and the spine form an obtuse angle with each other; the sacrum lying above and posteriorly; the symphysis anteriorly, and below. In the living female, when the womb, enlarged by gestation, is resting on the brim, the mouth or neck lie inferiorly and backward, while the fundus or upper parts are placed anteriorly so as to lie out beyond the ensiform cartilage. By a knowledge of these facts we are enabled to place our patients in positions which will materially facilitate obstetric operations.

38. In placing the brim vertically the body should be inclined forwards in its horizontal position; the patient should be placed in the semi-recumbent posture, or half sitting, half lying; if, for the reduction of a retroverted uterus, it is desirable to invert the plane of the brim, this may be effected by placing the patient on her knees and elbows.

39. The observation that the whole of the female skeleton is in general smaller, lighter, and smoother than that of the male, is particularly applicable to the female pelvis; in addition to which we cannot fail to notice that the spines and processes of the ossa innominata are farther distant from each other.

40. The os sacrum is broader and incurvated to enlarge the cavity of the pelvis. The wings of the ossa ilia are flatter and more expanded: in the male the brim of the pelvis is circular, and has its greatest extent between the ossa pubis and os sacrum; in the female the brim is oval, and the largest diameter is from side to side.

41. In the male the pelvis is of considerable depth; in the female it is shallow. The arch of the pelvis in the male is contracted; in the female it is capacious to make room for the head of the child. In the male the outlet is small; in the female of considerable capacity.

42. *Of the head of the child, and its passage through the pelvis.*—Having now completed our observations on the pelvis generally, and having noticed its particular properties, and the various purposes they are intended to promote, we shall proceed to examine the structure and dimensions of the child's head; as, on the proportion which these measurements bear to the bony canal through which it is destined to pass, the facility or difficulty of delivery will much depend. The head, which is oviform in its shape, has its greatest length from the chin to the vertex, which, on the average, is about five inches and a quarter; from side to side, between the tuberosities of the parietal bones, the measure is three inches and a half; from the lower part of the occiput to the upper part of the forehead it is about four inches; and, from the lower part of the forehead to the upper part of the occiput, about four inches and a half. These are the average or standard dimensions of the head; yet it is clear, owing to the nature of the sutures, and the conformability of the bones, the shape of the head may be altered, and its length be increased, while its breadth is diminished. Dr. Joseph Clarke (Philosophical Transactions, vol. lxxvi.) says that the size of the male head is generally a twenty-eighth or thirtieth part larger than that of the female; and he farther supposes that one-half more of our males than females are born dead, owing to tedious labor, or increased pressure on the brain; and to the same causes he ascribes the greater number of deaths of males soon after birth. In twin cases again, as the children are smaller, he calculates that only one-fifth more of males than females are still born.

43. The head of the child differs from the head of the adult; the cranium of the latter is completely ossified, and consequently firm, compact, and unyielding. The fœtal cranium, on the contrary, is made up of various bones, loosely connected by membranes, and possessing a degree of flexibility, which admirably adapts it to the pressure it may have to sustain in its transmission through the pelvis. Its sutures are not riveted together, the bony edge of one bone being directly united with the bony edge of the adjoining, as in the adult: they are maintained in connexion by the interposition of cartilage; and hence arises the great conformability of the fœtal skull, the advantage of which cannot fail to be perceived when its bulk is greater than natural, or when there is any diminution of the capacity with any deformity in the shape of the pelvis.

44. The frontal, the parietal, the occipital, and the temporal bones, compose the projecting part of the cranium, and it is in the connexion of these bones by suture that certain indications arise which it is of great importance to the accoucheur fully to understand.

45. The frontal suture unites the two pieces of the os frontis together, and is stretching from the sagittal suture to the root of the nose. The coronal suture extends across the head from ear to ear, crossing the sagittal and frontal at right angles, and joining the os frontis to the ossa parietalia. The lambdoidal suture is situated posteriorly, and unites the occipital bone with the ossa parietalia. The sagittal, the most important suture of all in practice, passes from the front of the head to the back, uniting the ossa parietalia to each other. If we examine the fœtal head still further we shall perceive two openings, formed by a deficiency of bony matter, which slightly pulsate, and which are denominated the fontanels. The large fontanel is situated anteriorly, at the junction of the sagittal and frontal with the two limbs of the coronal suture; it may be distinguished by its quadrangular shape, by its extent, and by the meeting of four sutures for its formation. The lesser fontanel is situated posteriorly at the point of union between the sagittal and lambdoidal sutures, and is distinguished by its triangular shape, and by the meeting of only three sutures for its formation. These remarks comprise the whole of what is important to be known, in relation to the standard head of the fœtus; and we shall now pass on to explain the mode by which the child passes into the world, previously premising that by the term presentation we mean that part of the child which lies over the centre of the pelvis, and by the term situation, when speaking of the passage of the child through the pelvis, we mean its place in relation to the surrounding bones. Thus, when the vertex presents, one ear is situated in the symphysis pubis, and the other to the sacrum, the face is towards one side of the pelvis, and the occiput to the other.

46. Burns, in the third section of his fifth chapter, has given a very simple description of the progress of the head through the pelvis, which we shall present to our readers. He says, by comparing the size of the head with the capacity of the pelvis, it is evident that the one can readily pass through the other. But he apprehends that the comparison is not always correctly made; for the child does not pass with the long diameter of its cranium parallel to a line drawn in the direction of the long diameter of the brim of the pelvis, but it descends obliquely, so that less room is required. The central portion of the sagittal suture passes first, the chin being placed on the breast of the child. Now, the length of a line, drawn from the nape of the neck to the crown of the head, is three inches and a half; a line intersecting this, drawn from the one parietal protuberance to the other, measures no more. We have, therefore, when the head passes in natural labor, a circular body going through the brim whose diameter is not above three inches and a half, and thus no obstacle or difficulty can arise from the size of the

pelvis. There is so much space super-abounding, betwixt the pubes and the sacrum, as to prevent all risk of injury from pressure on the bladder, urethra, or rectum; and, as the long diameter of the head is descending obliquely, the sides of the brim of the pelvis are not pressed on. This is so certainly the case that the head may, and actually often does, pass without any great additional pain or difficulty, although the capacity of the pelvis be a little contracted. But when the shoulders, which measure five inches across, come to pass, then the brim is completely occupied. If, however, any contraction should take place in the lateral diameter, the child would still pass one shoulder, descending obliquely before the other.

47. It is of great consequence to understand the passage of the child's head in natural labor, for upon this depends our knowledge of the treatment of difficult labor. The head naturally is placed with the vertex directed to one side, or a little towards the acetabulum; and the forehead, owing chiefly to the action of the promontory of the sacrum, is turned in the same degree towards the opposite sacro-iliac junction. When labor begins and the head comes to descend, the chin is laid on the sternum, and the central portion of the sagittal suture is directed downwards, nearly in the axis of the brim of the pelvis, when, by the contraction of the uterus, the head is forced a little lower, its apex comes to touch the plane of the ischium. Upon this the posterior sloping part of the parietal bone slides downwards and forwards, as on an inclined plane, the head being turned gradually, so that in a little time the face is thrown into the hollow of the sacrum, and the vertex presents at the orifice of the vagina. This is not fully accomplished till the cranium has got entirely into the cavity of the pelvis. As the basin is shallow at the pubes, the head is felt near the orifice of the vagina, and even touching the labia and perinæum, before the turn is completed, and when the ear is still at the pubes. The head, while its long diameter lies transversely, continues to descend in the axis of the brim of the pelvis, but when it is turned it passes in the axis of the outlet. When the turn is being made the direction of the motion is in some intermediate point; and this fact should, in operating with instruments, be studied and remembered.

48. When the pelvis is narrow above, and the sacrum projects, the hemispherical part of the head is long before it reaches the inclined plane of the ischium; and, when the head is lengthened out so as to come into contact with it, we find that, although the projection of the sacrum directs the vertex sometimes prematurely a little forward, yet the tendency to turn fully is resisted by the situation of the bones above, a great part of the cranium and all the face being above the brim, and perhaps in part locked in the pelvis. By a continuation of the force, the shape of the head may be altered; even the vertex may be turned a little to one side, its apex not corresponding exactly to the extremity of the long diameter of the head; the integuments may be tumefied, and a bloody serum be effused between them, so as greatly to disfigure the presentation. As therefore in tedious labor, occasioned by a deformed pelvis, the skull may be much lengthened and misshapen, we are not to judge of the situation of the head by the position of the apex of the tumor which it forms; but we must feel for the ear, which bears a steady relation to that part of the head which presents the obstacle. The back and upper part of the head are compressible, but the base of the skull and face are firm. A line drawn from the neck to the forehead, passing over the ear, is to be considered as the boundary betwixt these parts of opposite character; and therefore we attend to the relative situation of the ear, as it ascertains both the position of the head and its advancement through the brim.

49. *Of deformity of the pelvis.*—Under this appellation we intend to class all those deviations from the standard pelvis which at all interfere with the natural progress and completion of labor. It will be manifest, from a slight examination of the deformed pelves which are to be found in our museums, that distortion may arise from various causes, and that no part of this bony structure is exempted from its prejudicial influence. It is, however, a pleasing circumstance, that we do not frequently meet with those higher degrees of contraction which require us to sacrifice the life of the child to the safety of the mother.

50. Fracture and rickets are not infrequent causes of a distorted pelvis; but to mollities ossium, or a softness of the bones, we may attribute the majority of cases; and here the false as well as the true pelvis partakes of the deformity, and, of this latter region, both the brim and the outlet may exhibit incurvation. Frequently, where there is a good deal of distortion about the pelvis generally, certain parts may suffer much less than others; thus while the brim is greatly distorted the outlet may deviate but slightly from the standard dimensions. Specimens are in existence which, while they show great contraction or distortion on one side, make a near approximation to the natural dimensions on the other.

51. Dr. Blundell observes that, these distortions of the pelvis occurring, there is no end to the variety of forms the bones may assume; nevertheless he has observed, on making an examination of his specimens, that there are two leading shapes or forms to which these varieties may be reduced, and which may not be inaptly denominated the angular and the ellipsoidal.

52. At the brim we sometimes meet with elliptical distortions produced by the approximation of the promontory of the sacrum towards the symphysis pubis, the length of the brim being increased between the sides, and abbreviated between the front and back. At the outlet, also, the ellipsoid contraction may occur, the symphysis pubis being approximated to the lower extremity of the sacrum and the coccyx, so as to obstruct or render impracticable the passage of the fœtus, even after its bulk has been reduced by the perforation.

53. The second variety, or the angular form of distortion, is produced at the brim in consequence of the acetabula and the promontory of the sacrum being all of them pushed inward upon the

axis of the pelvis; of this kind of distortion Dr. Blundell once possessed an example in which the acetabula and promontory were so nearly approximated that the brim was, as it were, divided into three fissures, two laterally and one in front. At the outlet, also, the angular distortion occurs; and here it is occasioned by the approach of the tuberosities of the ischia, and the incurvation and advance of the sacrum and coccyx.

54. We believe that, in the greater number of instances of deformity, the brim of the pelvis is principally in fault; and that, when the contraction of this part is so considerable as to require the employment of instruments, it will most frequently be found narrowed from before backwards and not from side to side: the contraction here may arise from an approximation of the ossa pubis to the sacrum, or from the acetabula encroaching upon the diameter of the brim in the same direction.

55. In addition to these obstacles to parturition, there may be impediments arising from other causes. Exostosis from the pelvis bones may materially diminish the capacity of the brim, the intermediate cavity, or the outlet. Steatomatous and scirrhous tumors, incapable perhaps from their size or hardness of being pushed out of the way of the child's head may as seriously obstruct the progress of labor, as though they were producing absolute distortion. An enlarged ovarium or vaginal hernia may oppose delivery, and instances are on record where such obstacles have been attended with fatal results.

56. Mr. Burns once met with a dreadful case of tumor obstructing delivery, which we shall relate in his own words, as it is highly creditable to his skill and courage. The attachments of this tumor were so extensive, and it was of so great size as to fill the pelvis, permitting only one finger to be passed between it and the right side of the basin. It adhered from the symphysis pubis round to the sacrum, being attached to the urethra obturator muscle and rectum intimately adhering to the brim of the pelvis, and even overlapping it a little towards the left acetabulum. It was hard, somewhat irregular, and scarcely moveable. The patient was in the ninth month of pregnancy; there was no choice, except between the Cæsarian operation and the extirpation of the tumor. The latter was agreed on, and with the assistance of Messrs. Cowper, Russell, and Pattison, Mr. Burns performed it on the 16th of March, a few hours after slight labor pains had come on. 'An incision was made on the left side of the orifice of the vagina, perinæum and anus through the skin, cellular substance, and transversalis perinei muscles. The levator ani being freely divided, the tumor was then easily touched with the finger. A catheter was introduced into the urethra, and the tumor separated from its attachments to that quarter. It was next separated from the uterus, vagina, and rectum, partly by the scalpel, partly by the finger. I could then grasp it as a child's head, but it was quite fixed to the pelvis. An incision was made into it with the knife, as near the pelvis as possible; but, from the difficulty of acting safely with that instrument, the scissors, guided by the finger, were employed when I came near the back part; and, instead of going quite through, I stopped when near the posterior surface, lest I should wound the rectum or a large vessel, and completed the operation with a spatula. The tumor was then removed, and its base or attachment to the bones dissected off as closely as possible. Little blood was lost, the pains immediately became strong, and before she was laid down in a bed they were very pressing. In four hours she was delivered of a still-born child above the average size; peritoneal inflammation, with considerable constitutional irritation, came on; but, by the prompt and active use of the lancet and purgatives, the danger was soon over, and the recovery went on well. In the month of May the wound was healed. On examining her vagina, the vagina is felt adhering as it ought to do to the pelvis, rectum, &c. The side of the pelvis is smooth, and a person ignorant of the previous history of the case, or who did not see the external cicatrix, would not be able to discover that any operation had been performed. After a lapse of more than two years she still continues well.'

57. A small pelvis will occasionally give rise to difficulty in parturition; for although it generally happens, if the woman be small, that her child will be small also, and as this kind of pelvis exists apart from contraction, maintaining indeed its shape and symmetry, labor will very frequently proceed with facility. Yet it may so happen that a small woman shall produce large fœtuses. An instance of this lately occurred to us, where, in consequence of the disproportion existing between the child and the pelvis, we were compelled to use the perforator, after having in vain employed the forceps.

58. The treatment of these cases is by no means easy; we are only aware, indeed, of two methods, by which, if the deformity extreme, and the full term of pregnancy be completed, women can be relieved from this most calamitous situation. We may perform embryotomy or the Cæsarian operation. And, in relation to the first of these proposals, Burns has ascertained that when the standard head is reduced in the best possible way, by the removal of the frontal, parietal, and squamous bones, it will require for its passage an aperture of three inches in length, and of one inch and three quarters in breadth. If this space does not exist, the Cæsarian operation, of the success of which we do not in this country entertain any very favorable anticipations, must be resorted to.

59. Mr. Barlow, of Blackburn, used to relate the following case:—A robust countrywoman in vigorous health, the mother of several children, was thrown out of a cart, which went over her and broke her pelvis to pieces. She was carried home, and lay a long time; but at last recovered. She again became pregnant, and was attended by a woman; but the pelvis was so contracted by the displacement of the fractured bones, and the mass of osseous matter by which they were consolidated, that the midwife was unable to deliver her. Mr. Barlow was now called in, and was persuaded she could not be delivered without the Cæsarian operation. As

soon as she was willing to submit to it, feeling there was no hope in any other way, he performed it, and a dead child was extracted. The mother herself did very well; in a fortnight after the incisions were made she got up, and in three weeks she was attending to her usual concerns.

60. In cases where the deformity does not so materially diminish the capacity of the pelvis as in the instances we have described, we shall be justified in waiting for the full exertion of the natural powers. The obstacle may exist in one particular point of the brim, and, this being surmounted, the future progress of the labor may be uninterrupted. We have ourselves been surprised, after waiting twenty-eight hours without any advance of the head, and having determined to perforate, suddenly to discover that the difficulty was overcome, and the labor was completed with unusual celerity. It may appear singular, but it is nevertheless true, that such changes do arise as sometimes to render the use of instruments unnecessary in a labor occurring in immediate succession to one where their employment had been absolutely required. We were once called to a case of presentation of the breech, where, owing to contraction of the brim, from before backwards, we were compelled to diminish the capacity of the head before we could extract the child. This lady again became pregnant, and at the commencement of labor it was ascertained that the vertex presented, the waters passed off, and the pains continued remarkably powerful and forcing for eighteen hours. At the expiration of this time she was much exhausted, but the head remained immoveably jammed at the brim. The long forceps was applied, but no justifiable force which could be exerted with it enabled us to surmount the obstacle, and we were at length driven to the use of the perforation. In a third labor of this lady, occurring at the full time, although summoned very early we could not reach her before the birth of an average-sized child. A fourth labor, in which we have only a few weeks since attended her, has proved equally fortunate, and the child is by no means small.

61. Dr. Blundell's rule in cases of this kind, and indeed whenever instruments are thought to be required, is remarkably simple and very applicable. If, says he, no dangerous symptoms appear, we ought to give a fair trial to the full efforts of the uterus for twenty-four hours, after the discharge of the liquor amnii, abstaining as long as may be from the use of instruments, for they are great evils, and a meddlesome midwifery is bad. But should dangers arise referrible to the prolongation of the labor, or should the woman be in labor for twenty-four hours after the discharge of the waters, the head not advancing, a trial of the lever or forceps becomes necessary. Further, should the dangerous symptoms become pressing, or should the womb have been in action for eight-and-twenty hours, the head still not advancing, the perforator must be employed. Again, a woman may have had several children destroyed in succession, and, pregnancy still occurring, she is very anxious to become the mother of a living child. Here we may propose to induce labor at seven months, or seven months and a fortnight; thus preventing that complete growth of the fœtus which in all probability renders its destruction unavoidable; and, as children do live when born at this period, we give our patient a chance of bringing into the world a living child.

62. It is possible that women who are known to have very considerable deformity of the pelvis may become pregnant; and perhaps this may occur after their lives have been put in the utmost jeopardy by a previous case of embryotomy. Dr. Blundell has made a proposition for the management of these cases, which deserves to be mentioned. Let us suppose that a woman is not advanced above two or three months, and that an attempt to discharge the liquor amnii has failed. Under these circumstances he strongly recommends an opening to be made a little above the symphysis pubis, in or near the linea alba, carefully avoiding the bladder; at this opening introduce the fore finger of the left hand, so as to get a bearing on the uterus; this accomplished, take some slender-pointed instrument, and pretty stiff, and, by a sort of acupuncture, carry this instrument through the body of the uterus into its cavity, and on entering the uterine cavity move the wire cautiously, yet effectually, in different directions, so as to break the ovum all to pieces, and put an enectual stop to the generative process. The ovum destroyed, draw up the fallopian tube, which is easily done; first on the one side, then on the other, cutting out a portion of it, so as to render it impervious, by which you secure future sterility. In performing the operation great care is to be taken that the ovum is thoroughly broken up, even if it occupy fifteen or twenty minutes.

63. *Large pelvis.*—Having described the difficulties incident to those deviations from the standard pelvis which are produced by contraction and distortion, as well as those which arise from a pelvis naturally small, yet retaining its symmetry and shape; we shall now detail the inconveniences produced by a pelvis exceeding in its dimensions that which we denominate standard.

It is very evident that difficulty in the passage of the child cannot originate from a pelvis of this kind. The uterus may, however, in consequence of augmented pelvic capacity, remain long below the brim, and thus increase the probability of its prolapse; and, if the bladder be distended, of its retroversion.

64. These are circumstances which will readily suggest themselves on the slightest reflection, and we need not dwell on the treatment by which they must be remedied. Another, and perhaps the most serious evil arising in cases of this kind, is the suddenness with which labor may come on, the uterus descending to the orifice of the vagina before the os tincæ is fully dilated. We were in attendance not long since on a patient who had borne many children, where the pelvis was capacious, and the softer parts relaxed. A few monitory and slight pains had been experienced, but as there was scarcely any progress made, we were preparing to leave the house; before we reached the door one single

pain expelled the child. Occurrences of this nature should induce great caution whenever we are called upon for a legal opinion. A woman, pregnant perhaps for the first time, and of an illegitimate child, is naturally ignorant of the changes which precede labor; her pelvis is unusually large, and in an attempt to relieve the bowels the child is suddenly precipitated into a situation where its destruction is inevitable. All this may occur without any guilty intention on her part to sacrifice the infant; and in a court of law she ought to have the full benefit of these palliative circumstances.

65. *Deviations from the standard head.*—A head unusually small, as we have just now observed of a pelvis unusually large, can originate no difficulties in parturition. The converse of this proposition is true of a head which exceeds in its dimensions that with which we generally meet; more especially if the pelvis be small, and the bones of the head more than commonly ossified.

66. When the vertex or face has been long incarcerated at the brim, or in the cavity of the pelvis, it is very possible to be deceived as to the part which really presents. If the face be over the centre of the pelvis it may suffer compression, the blood accumulating, and the soft parts becoming swelled and tense. Here we do not find the inequalities which generally characterise this presentation; the same remarks may be reiterated of the vertex, where it has been long detained in its passage through the pelvis. We have seen many cases where the scalp has been so exceedingly tumefied as to resemble the breech more than the head. The hydrocephalic cranium may generally be detected by the distension and stiffness of the vertex, by the breadth of the sagittal suture, and perhaps by an obscure fluctuation in this part, and towards the fontanel. We are not always to suppose that a watery head presents insuperable obstacles to the completion of the birth by the natural efforts; give to these efforts a fair trial, and the result will frequently exceed the most sanguine expectations; for, although there are many in which instrumental aid will be required, yet if we act in accordance with the rule already laid down, of not interfering till after a certain period, and not even then unless symptoms arise plainly indicative of constitutional and local excitement, we shall frequently be gratified by the emergence of the head, without the assistance of either the forceps or the perforator. These remarks are equally applicable when there is disproportion between the size of the head and the capacity of the pelvis; ever remembering that the bones of the fœtal cranium may by compression very much overlap each other, and thus its bulk may be so far diminished as to bring it within the successful influence of the uterine powers.

67. We cannot better conclude this section of our subject than by quoting the words of Bandelocque, a name of high repute in obstetric science. 'The accoucheur,' says this author, 'who has not yet by long practice enabled himself to form a just estimate of the process of nature, may easily deceive himself in these cases, and in the first judge a delivery to be impossible which is ready to terminate, and in the second declare that to be easy which is about to be opposed by difficulties, that art can alone surmount; or which at the least, render it extremely tedious and painful. More than forty persons were witnesses to the disagreeable consequences of a mistake of this kind, in a woman whose pelvis he possessed. The operator having pronounced that the woman would be speedily delivered, on account of the facility with which the child's head had engaged with the first pains, and attributing the obstacles which soon after obstructed its passage to another cause, and not to the narrowness of the inferior strait, which had remained unnoticed, he waited two days in perfect security; and then, by a more blind temerity than the former, used the crotchet on a child whose life might have been by other means preserved.

68. *Of pelvimeters, or the examination necessary to ascertain whether the pelvis be well or ill formed.*—A variety of instruments have been devised for obtaining an accurate knowledge of the different measurements of the pelvis; some being constructed for the attainment of this information from within the pelvis, while others, with the same design, have only been intended for external application. It is evident that much difficulty must be experienced in the use of mechanical means for this purpose; and, even when employed successfully, we doubt whether their indications be superior to those which may be procured by the skilful and experienced enquiry of the fingers. We believe, if the fore finger be passed to the brim of the pelvis, a sufficiently correct notion of its capacity for obstetric purposes may be secured, by carefully noting the length of space it requires to pass from the symphysis pubis to the promontory of the sacrum, and the extent it must traverse before it can stretch from one side to the other. By moving about the fingers in the cavity and the outlet, similar information may be acquired; and if in addition to all this we ascertain whether the head has entered the brim to any extent, and the time which has been required for the progress thus far, we shall not be very ignorant of the dimensions of this most important part. The only pelvimeter we have seen, of easy application, is one designed to measure the pelvis externally. It may be denominated a pair of callipers, one leg of which is fixed on the symphysis pubis, and the other a little below the spine of the last lumbar vertebra, three inches being allowed for the thickness of the sacrum and the symphysis: thus, if the thickness of the whole be seven inches, we deduct three, leaving four inches as the measurement of the brim, in its antro-posterior diameter. Bandelocque expresses himself well pleased with this kind of measurement, and says that he has not found a difference of a line in the examination of five-and-thirty pelves, distorted and contracted in all ways and in all possible degrees. The roundness of the hips, and their equality, the prominence of the mons veneris, the space of eight or nine inches between the anterior superior spines of the ossa ilia, and the moderate depression of the superior and posterior parts of the sacrum, are evidences of a

favorable conformation. The converse of these circumstances, more especially if there be any curvature of the lumbar spine, denotes a faulty construction of the pelvis.

69. *Of the soft parts contained within the pelvis.*—The observations hitherto made on the pelvis have referred to that condition where it is divested of the lining it receives in the recent state, from muscles as well as from ligamentous and membraneous expansions. There can be no doubt, that the structure of parts is much better understood in this way; for, by regarding them at first as they really are in the skeleton, we acquire much clearer notions of the purposes they serve, of the manner in which other parts exert their influence upon them, and of the combined and finished operations of the whole. The necessity of some lining of this kind is sufficiently manifest when we consider the importance and delicacy of the organs situated in the pelvis; among which may be enumerated the uterus, urethra, bladder, and ovaries, fallopian tubes, rectum, &c.

70. The pelvis has been frequently described as connected with the cavity of the abdomen; but, as we shall not meddle either with the structure or diseases of the abdominal organs, it appears desirable to look upon the pelvic cavity as distinct from that of the abdomen. We find two muscles at each side of the pelvis internally, the iliacus and the psoas. The former by its radiated fibres fills up the iliac fossæ; and the psoas, originating from the lateral parts of the lumbar spine, descends to the inner edge of the brim to be inserted with the psoas, into the trochanter minor of the femoral bone. The levator ani is arising from the whole circumference of the brim of the pelvis, and descending, may be traced all the way round to the extremity of the rectum. Under the symphysis it is pierced by the urethra and vagina, and, during the passage of the child's head, it is easy to suppose that these fibres must be considerably stretched and distended.

71. From the membrane that fills up the thyroid hole, and from the inner surface of the ischium, the obturator internus arises, running backwards and downwards, and terminating by a tendon to be inserted into the rest of the trochanter. The pyriformis originates from the under part of the hollow of the sacrum, and passes out at the sacro-sciatic notch to be inserted with the obturator. These muscles sustain pressure and perhaps injury in difficult and protracted labor, which may explain the uneasiness so often felt in moving the thighs. The coccygeus commences from the spine of the ischium, running posteriorly to be inserted into the side of the coccyx, in order to move and support it. We now see how the pelvis is lined with muscular substance, affording a slight compressible support to the gravid uterus and pelvic viscera. On a parallel with the inner margin of the psoas, along the posterior half of the brim of the pelvis, we find the course of the iliac artery and vein, and encroaching a little when distended on the lateral capacity of the brim. They quit the linea-ilio pectinea at between two and three inches from the symphysis, and, passing over the acetabula, they leave the pelvis with the psoas muscle. The iliac vessels escape pressure entirely during labor, but the hypogastric must in certain positions and sizes of the head sustain pressure.

72. The first, second, and third pair of lumbar nerves, furnish some branches, which, passing out through the substance of the muscles lining the iliac fossæ, supply the upper and outer parts of the thigh; and it is to the stretching and tension of these nerves, especially in the latter periods of gestation, that we must attribute the painful uneasiness which is so often experienced about the pubes, groins, and in the small of the back. So likewise we must attribute to the obturator and crural nerves that weakness and uncertainty of gait which characterises some pregnant women. The lymphatics preserve the same course as the iliac vessels, forming a plexus from Poupart's ligament to the lumbar vertebra. The rectum is by no means an unimportant part of the contents of the pelvis; it is situated at the left side of the projection of the sacrum, and is known sometimes to acquire an immense size from the accumulation of feculent matter, giving rise to very uncomfortable feelings.

On Menstruation.

73. A description of the external and internal generative organs of the female having preceded this article, we shall refer the reader to the treatise on Anatomy, for any information he may require, and go on to notice the important function of menstruation. We do not pretend to throw any new light on the causes of this periodical discharge, with which the health and comfort of the sex is so intimately associated; but we shall endeavour to place before our readers a clear narration of the various circumstances which are found to belong to its healthy and morbid conditions. We are not aware of any change which so much affects the whole course of female life as menstruation. Every process of the female economy to the time of puberty is incomplete and defective, if the menses do not appear; and in after years, when the generative faculties are in exercise, and when the most important functions and duties of female life are to be performed, their health and efficiency are most materially dependent on the regularity and natural character of the menstrual fluid:—and it is equally notorious, when women have passed the middle period of life, and have escaped the dangers incident to parturition, that they may be yet placed in jeopardy, by the final cessation of this function. We believe there is now little difference of opinion as to the nature of the menstrual fluid. That it is not blood seems sufficiently evident from its scarcely possessing one property in common with it, excepting the color; and even here there is not perfect agreement; for, while the coloring matter of the menstrual fluid is permanent, that of the blood is not so. In the London Practice of Midwifery, it is stated that Mr. Brande analysed some menstruous discharge, sent to him by Mr. Money of Northampton, which was collected from a woman with prolapsus uteri, and was consequently perfectly free from admixture of other secretions. It had the properties of a very concentrated solution of the

coloring matter of the blood in a diluted serum. It has been observed that artificial solutions of the coloring matter of the blood invariably exhibit a green tint, when viewed by transmitted light. This peculiarity is remarkably distinct in the menstruous discharge. No globules could be discovered in this fluid; and, although a very slight degree of putrefaction had commenced in it, yet the globules observed in the blood would not have been destroyed by so trifling a change. The menstrual fluid does not soon putrefy, even if exposed to summer heat, nor does it coagulate; and we particularly remember that Mr. Mansfield Clarke, in his lecture on this subject, exhibits a specimen of the menstrual discharge, which has remained in a fluid state for many years. Much more might be said on this point; but we conceive we are fully justified, from what has been already advanced, in defining the menstrual fluid to be a secretion from the uterine arteries, and perfectly different from blood.

74. The age at which menstruation begins varies in different individuals, as well as in different climates. In this country its commencement may generally be dated from the fourteenth or fifteenth year, while in Persia the females advance to womanhood at nine or ten years old; but in Lapland, and the north, puberty does not arrive till the age of eighteen or twenty; and, according to some authors, menstruation in these very cold countries only occurs in the summer season. There is a great variety in the quantity of the discharge; for while in this country from four to six ounces are generally lost at each period, in the east, and in the Archipelago more especially according to Hippocrates, eighteen or twenty ounces of this secretion are thrown forth from the uterus. The time during which women continue under the influence of this discharge is not regulated by any very certain rule. The author of this paper has attended two patients, one of whom invariably continues unwell eight or nine, and the other never more than two days, and yet they are both equally healthy. Writers do, however, agree in considering three or four days as the average time. The commencement of menstruation is generally, though not invariably characterised by attendant indisposition. On enquiry, we frequently find that there are uneasy sensations in the stomach and bowels, distressing feelings of languor and pain in the lumbar and pelvic regions, accompanied by anomalous and hysterical symptoms.

75. These affections may not be immediately succeeded by the discharge; for, in the majority of cases, the health is slightly impaired for two or three months. During one of these seasons of indisposition, when these ailments are perhaps more than usually severe, a serous discharge takes place from the vagina, at first only slightly red, and not becoming entirely sanguineous for several periods. The health continues frequently delicate till the full establishment of this new function; after which, if there be no suppression from exposure to cold or general illness, menstruation may continue to be performed for many years, without any other inconvenience than a slight pain in the back, or trifling hysterical complaints.

76. Nor is this period of female life unattended by alterations, both in character and person, which fully denote that the age of puberty has arrived. The complexion of girls is improved, their countenance is more animated, the tone of their voice more harmonious, their mental powers are much stronger, and they have acquired dispositions and feelings of which they were previously unconscious. The uterus and the vagina are increased in size, the mons veneris is developed and covered with hair, the pelvis is augmented in capacity, and the glandular substance of the breasts, as well as the cellular membrane with which it is invested, is gradually unfolded. Nec minus notum est, quanta virginea alteratio contingat, increscente primum et tepefacto utero; pubescit nempe; coloratior evadit, mammæ protuberant, pulchrior vultus renidet, splendent oculi, vox canora, incessus, gestus, sermo, omnia, decora fiunt.—*Harv. Exercitat de partu.*

77. Although the menses are invariably suppressed in pregnancy, and generally during lactation, their appearance in the latter state is by no means an unfrequent occurrence.

78. The cause of menstruation has greatly exercised the ingenuity of professional men; for while some have attributed it to the influence of the moon, others have supposed it to result from a ferment in the blood, or more especially in the uterus. Dr. Cullen thought that this discharge was not dependent on general but local plethora, and that the uterus was thereby fitted for the healthy discharge of its functions. That the moon exerts no influence in menstruation is evident from the fact that women, and even the same woman, menstruates on every day in the month, without any regard to lunar increase or decline. No part of the anatomical structure of the womb seems to favor the opinion that it may be attributed either to general or uterine ferment; nor are we at all more successful when we look for its cause in universal or local plethora. Were this the case, the quantity of menstrual fluid ought to be influenced by the abstraction of blood from the arm, before or during menstruation, which is not the fact. We were lately particularly impressed with the superior relief of pain afforded only by the commencement of the discharge, to that which we procured by the abstraction of blood in a patient, who was supposed to be suffering under peritonæal inflammation, and from whom under that impression sixteen ounces of blood were abstracted. She had long been the subject of dysmenorrhœa, and in twelve hours after the venesection she became unwell, and the cessation of the pain, which was scarcely relieved by the bleeding, was remarkably manifest and decided. Further than this, women in whom no kind of plethora can by possibility be supposed to exist, who, in consequence of dissipation, have impaired their appetites and diminished their strength, yet regularly menstruate.

79. We believe it to be one of the instances in which the researches of able and intelligent men will terminate in their tracing it to the will of the Creator; in other words, they will regard it as a law of nature, that the fleshy uterus of the human female shall, once every month, by a secretory action, produce a certain sanguineous fluid. If there are some women to whom the menses are

denied, and such instances are on authentic record, nature almost invariably attempts to remedy the misfortune by setting up some other evacuation, which in a measure supplies the place of the proper one, as far as concerns their health. In some we find a periodical discharge of blood from the nose, from the anus, from the puncta lachrymalia, from the ears, or the nipples, and Baudelocque knew a woman of seven or eight and forty who, from the age of fifteen, had been regularly attacked every month by a vomiting and purging, which lasted three or four days. She never had the menses.

80. The penal regulations adopted by the Jewish legislator, and promulgated in Leviticus, and which were afterwards carried out by the physicians of the Arabian schools and their successors, originated the belief that some peculiarly noxious properties were inherent in the menstrual discharge. It is certain that in Holy Writ there are the most precise and authoritative directions as to every circumstance connected with this function; and, supposing them to have no other end in view than the simple prevention of intercourse and the disposal of the secreted fluid, it is not to be wondered at that opinions of its baneful influence should have arisen. In our own times these apprehensions are nearly if not entirely extinct, and in this country women are subject to no restraint or separation during this periodical secretion. Peculiar circumstances, as impaired health and diseased states of the uterus, may render this discharge slightly more offensive and acrimonious than the great volume of the circulating fluid;* but with these exceptions we entertain no other notion respecting it than that it is entirely innocuous.

81. Menstruation is generally supposed to serve the important purposes of maintaining the uterus in a state fit for conception, and during pregnancy of affording nourishment to the child. To the former of these opinions we unhesitatingly subscribe, as we believe every fact in physiology demonstrates the impossibility of conception where menstruation from the uterus does not exist, although there may be vicarious discharges from other parts of the body. Thus far we proceed on certain grounds, and if we remain in doubt as to the precise kind of influence which menstruation exerts on the female system, as a whole, we have no hesitation in believing that it is absolutely essential for the healthy performance of the function of the uterus. The œstrum of animals, when they are salacious, may be regarded as equivalent to menstruation; and, although it is most frequently mucous, yet in very hot seasons and climates it has been frequently observed to be sanguineous.

The latter opinion, that the menstruous blood during pregnancy serves for the nourishment of the fœtus, is not very satisfactory. We find all animals, whether menstruating or not, nourishing the embryo contained in their uteri; and if the whole quantity of menstrual fluid which would have been secreted, supposing pregnancy had not occurred, were bestowed on the fœtus, we cannot suppose that it would contribute very materially to the building up of a child whose weight at the birth is, on an average, from eight to ten pounds.

82. Women generally cease to menstruate in this country from the forty-fourth to the forty-eighth year; the precise time a good deal depending upon the early or late appearance of the secretion. Thus when menstruation commences at ten, twelve, or thirteen years of age, it will frequently disappear at forty; whereas if puberty, the consequence and not the cause of menstruation, has not been established till the sixteenth or eighteenth year, the menstrual discharge may continue till fifty-two or fifty-three, and even later than this. Women, however, seldom bear children in this country after forty-five or forty-six years of age; and thus the propagation of the species, and the active duties consequent thereon, are associated with the most vigorous periods of existence. 'Had any other law prevailed, children might have become parents, and old women might have borne children, when they were incapable of affording them proper nourishment.'

83. It is worthy of remark that the final cessation of the menses is frequently a critical time in female life. Tendencies to disease, and that of the organic kind, for years dormant, may now be excited into activity, and the uterus and mammæ demand watchful attention. The irregularity of the catamenia, and their obstruction for several months, sometimes induces swelling of the abdomen, sickness, and loathing of food. These symptoms resemble pregnancy; and there are some women, as La Motte remarks, who would rather persuade themselves that they are again to become mothers, than that they are growing old, and this persuasion they indulge; 'donec tandem spes omnis in flatum et pinguedinem facesseret.'

84. Dr. Marshall Hall, whose Commentaries on some of the more important Diseases of Females we would especially recommend to all who are interested in puerperal and parturient affections, observes that the general treatment, in regard to the final cessation of the catamenia, involves two points; the restoration of the general health, if this be impaired, and especially the daily observation of the state of the bowels, and attention to diet, air, and exercise; and the second to promote, by every gentle means, the flow of the catamenia when they do appear. The head is frequently requiring attention, as sudden flushes, vertigo, and drowsiness, are common affections at this time; nor can we too forcibly enjoin regular evacuations from the bowels, and the occasional abstraction of blood, by cupping, from the

* Penis cum menstruata concumbentis excoriatur: si novella vitis eo tangatur, in perpetuum læditur: steriles fiunt tactæ fruges, moriuntur insita, exuruntur hortorum germina: si mulier prægnans alterius menstrua supergrediatur, aut illis circumlinatur abortum facit; ei autem quæ uterum non gestat, concipiendi spem adimit, purgantis spiritus, et vapor ab ore, specula atque eboris nitorem obscurat: gustatus hic sanguis canes in rabiem agit, homines vero diris cruciatibus affligit, comitialem morbum, pilorum effluvium, aliaque elephanticorum vitia: idcirco à veteribus inter venena relatus; pari malignitate existimatur, atque sanguinis elephantiaci potus.

De Graaf, p. cxxiv.

back of the neck, not only during the exact period of the cessation of the discharge, but for some time afterwards.

85. Sir Astley Cooper and Dr. Farre have mentioned a case, occurring at this period, in which both the uterus and the mammæ became schirrous in the same subject. The period, says Dr. Hall, including several years before the disappearance of the catamenia, the space occupied by this change, and several years afterwards, may with great propriety be termed the first climacteric period of female life.

86. *Of diseased states of the menstrual secretion.*—It is the opinion of many that women suffer more than men at their approach to puberty; and judging from what we see in this country, where girls are luxuriously educated, often living in warm rooms, and lying on soft beds, we incline to this opinion. We believe there is little dispute as to the greater liability of women to cancer than men, especially at the final cessation of the menses. Notwithstanding these facts, we do think that certain advantages accrue to the sex from menstruation; more especially when discharges of blood are required for the relief of peculiar symptoms and conditions of the system, these are made with the utmost facility through the medium of the menstrual discharge, and not as is too often the case in men, when a vicarious secretion is necessary, with injury to the parts which furnish it. It cannot, however, be denied that the circumstances attendant on menstruation are frequently demanding medical relief, and we propose to consider them in the usual order.

87. *Obstruction of the menses.*—Authors have usually included two forms of disease under this denomination, that in which the menses do not appear at the period of life when they may naturally be expected, or emansio mensium; and that in which, having once appeared, they are suppressed or amenorrhœa. It is right to remark that these terms are frequently indiscriminately employed, and for ourselves we do not see any real distinction between them.

88. Amenorrhœa is a disease of such unbounded variety, and involving to so great an extent, if it be of long continuance, the health and energy of the system, as to preclude our entering fully into its details; we must content ourselves with observing, that it appears in some instances to spring from debility of constitution, while in others it is associated with plethora and florid complexion. The latter form of this affection is by far the most manageable; and, as it is generally more easy to remove that which is redundant than to furnish what may be deficient in the system, so we find in amenorrhœa, arising from fulness of circulation, that by the careful, and perhaps repeated abstraction of blood, by persevering attention to the condition of the alimentary canal, and by the observance of a spare diet, we soon induce the salutary flow of the menstrual discharge.

89. In chlorosis, on the contrary, characterised by pallor and slight tumidity of the countenance, by a quick and small pulse, and by a general exsanguineous state of the system; the treatment is by no means so simple or so quickly successful. The disease may be so confirmed and inveterate, and so mixed up with the affection of different organs, as to render the case truly perplexing. We frequently find, in this form of the malady, that the legs and ancles swell at night, and that the face and eyelids are puffy and distended in the morning.

90. The source of these appearances is œdema; and we know that the interstitial fluid lodged in the cellular substance of the face subsides during the day, the erect posture being generally maintained, and that the cells below are gradually filled again towards night, producing swelling of the ancles. It would be difficult, says Dr. Marshall Hall, to trace the series of causes and effects in the pathology of this affection; but I do think the first cause is in the state of the bowels; that a concurrent cause is the peculiarity of constitution already described; and that an exciting cause is the inactive and sedentary mode of life usually obtaining in female youth. The stomach suffers from its continuity with the intestines, the uterus possibly by contiguous, the head and the heart by remote, sympathies; the pain of the side is peculiar, and too common to be a mere accidental complication; and it therefore probably also depends upon the state of the large intestines.

91. To the symptoms already enumerated, we may subjoin those which arise from derangement of the stomach. Flatulence and capricious appetite are very distressing. The patient is annoyed by an uncontrollable desire for chalk, cinders, and other substances equally unnatural. The bowels are very irregular, sometimes very much confined, and at others in a state of diarrhœa. The breathing is hurried, performed with great difficulty on the slightest exertion, and there is often palpitation of the heart. Cullen says, as a certain state of the ovaria in females prepares and disposes them to the exercise of the genital organs, about the very period at which the menses first appear, it is to be presumed that the state of the ovaria and that of the uterine vessels are in some measure connected together; and, as generally symptoms of a change in the state of the former appear before those of the latter, it may be inferred that the state of the ovaria has a great share in exciting the action of the uterine vessels, and producing the menstrual flux. But, analogous to wha happens in the male sex, it may be presumed that in females a certain state of the genitals is necessary to give tone and tension to the whole system; and, therefore, that if the stimulus arising from the genitals be wanting, the whole system may fall into a torpid and flaccid state, and thence chlorosis and retention may arise.

92. The treatment of chlorosis was formerly conducted upon what may be termed the empirical plan. Specific medicines, called emmenagogues, supposed to exert an immediate influence on the uterus, in compelling it to secrete the menstrual fluid, were given; and very frequently with the smallest success. Blood-letting can very seldom be required in these cases; and we allude to it as we have lately witnessed its bad effects. A chlorotic patient was bled from the arm by her

medical attendant for the relief of difficult respiration, and was partially, of course not fully relieved. It was thought advisable to repeat the bleeding, which was again followed by temporary relief; after this period we saw the case, and nothing could be more conspicuous than its bad effects. Her prostration of strength was extreme; the breathing was more laborious, and an anasarcous state of the body was universally apparent. It is needless to remark that many months elapsed before an opposite plan of treatment was successful in the restoration of the health; and we are sure that events, similar to the one now related, have not unfrequently arisen from the too lavish use of purgatives.

93. We believe that venesection will generally aggravate the evils of this condition; for, while it affords only temporary relief, it will permanently augment the weakness, and the disposition to dropsy. Remedies of the tonic kind, although they may not directly induce the flow of the menses, will certainly where there is pallor of the countenance, with the other indications of debility, facilitate the desired result. Previously to their use some mild aperient, and perhaps a gentle emetic, should be administered. We prefer the preparations of iron to any other remedies of this class, and we have seldom experienced any decided difficulty in their exhibition. Either the sulphate or the carbonate may be employed. The diet should be generous, and wine and water may be allowed. Exercise is very important; and dancing, riding on horseback, or swinging, and country air, will exert a most beneficial influence. The chalybeate waters of our own country will be found a useful auxiliary to other means; and tepid bathing or pediluvia, as well as bathing in the sea, will be of use. Dr. Denman observes that the guides to the ladies contrive to go into the water during the time of menstruation, without any inconvenience. We must remember, in the exhibition of medicine for the removal of suppression of the menses, that there are peculiarities in the constitution of some women, which prevent the good effects of the most approved remedies. Here we are not to be discouraged, but we must call into action other means even if of less general efficacy.

94. All the remedies denominated emmenagogues possess a stimulating property, and their employment is of very doubtful tendency where there is exhaustion, or a large share of debility; if the patient, on the contrary, be plethoric, they are not without danger; for, failing to produce the uterine discharge, they may originate hæmorrhage in some other organ or part. Dr. Home has eulogised the powers of madder root, as a deobstruent in one or two large doses, immediately before the expected period, or in doses of half a drachm twice or three times a day during the interval. Friction of the lower extremities, and electricity, may be strongly recommended. As a local stimulant, and not liable to the objections already urged against constitutional remedies of a similar kind, we must not fail to mention the ammoniacal injection. We have used it many times; and in one or two instances, when the amenorrhœa was of several years standing, we have witnessed its decidedly good effects. It may be employed by adding ℨiß or ℨij of the liquor ammoniæ pur. to twelve or sixteen ounces of warm milk, and throwing up six or eight table spoonfuls into the vagina four or five times daily.

95. *Of menorrhagia, or profuse menstruation.*— Menorrhagiæ, Cullen, cxxxvii. dorsi, lumborum, ventris, parturientium instar, dolores; menstruorum copiosior vel sanguinis, è vaginâ præter ordinem fluxus.

96. This condition of the menstrual secretion is exactly the reverse of amenorrhœa; and if it has existed long, or to any considerable extent, the symptoms are similar to those which are produced by hæmorrhages of any other kind, only excepting the peculiar uterine circumstances with which they are associated. Authors generally describe two kinds of menorrhagia: that in which, by the frequency of return of the menses, a debilitating drain is set up; or when the period is not more frequent than natural, but when the quantity of blood lost at each time (for in excessive flow of the menses or menorrhagiæ the secretion is apt to assume the character of blood) is greater than is compatible with the strength of the patient.

97. We believe this disease most commonly arises from the hæmorrhages which accompany early abortions, or that it is symptomatic of some affection of the uterus itself. It may consist with very different states of constitutional power, either in those who are plethoric, robust, and vigorous, or where there is weakness and partial emaciation. In the one case the undue discharge occurs in consequence of distension or over action, in the other from debility. To whatever extent menorrhagia may proceed, it is invariably accompanied by indications of uterine irritation, such as pain in the back and loins, and about the pelvis, nor do the uncomfortable symptoms stop here: if there be frequent returns of the hæmorrhage, the general health suffers, the loss of strength is very manifest, dyspepsia harrasses the patient, leucorrhœa occurs in the intervals, and the foundation is laid of visceral disease, and eventually of dropsy.

98. Burns says that the causes giving rise to menorrhagia may be divided into those which occasion the two predisposing states of plethora and weakness of the vascular system, and those which act more immediately on the vessels of the uterus. Of the first kind, may be mentioned those which on the one hand increase the quantity of blood, as rich diet, indolence, &c.; and, on the other, debilitate the body, as fatigue, abstinence, and profuse discharges.

Amongst the exciting causes, or those more particularly affecting the uterine vessels, may be mentioned the excitement produced by costiveness, or dyspepsia, and that morbid condition of the womb occasioned by abortion, or laborious parturition.

Married women are most liable to menorrhagia; frequent parturition or undue lactation being a powerfully predisposing cause. We are now in attendance on a lady who, in opposition to advice, has persevered in nursing fifteen months with health gradually declining; for the

last half year she has regularly and rather excessively menstruated; but it was not till the weaning was fully accomplished, that any profuse hæmorrhage occurred; immediately on the completion of the process, the uterine vessels, weakened by the drain of long continued lactation, poured forth a large quantity of blood. A repetition of this hæmorrhage has prostrated her little remaining strength, and months will be required to restore her health.

99. The treatment must of course vary with the degree, and the longer or shorter continuance of the disease. The recumbent position, abstinence from stimuli and every kind of exertion, and perhaps, in the very commencement, venesection, will suffice for the removal of menorrhagia, where it is slight and connected with only an occasional feverishness of system. We must prohibit the use of animal food, and preserve an aperient, not a purged state of the bowels, by the infusion of roses and sulphate of magnesia. These measures will generally suffice for the removal of the simplest kind of menorrhagia; but when it is more severe we must resort to local measures, as the application of cold to the pudenda and loins, and, if necessary, the injection of styptic and astringent lotions into the vagina. There are cases, not of very unfrequent occurrence, in which astringent injections, and even cold water, cannot be borne, as they not only produce uncomfortable and painful sensations, and occasionally inflammation of the vagina and uterus, but manifestly increase the discharge. Here we must trust almost entirely to constitutional measures. Digitalis, in an excited state of the circulation, has been productive of great good; but the propriety of not lowering the patient, beyond the point absolutely required for the restraining of the hemorrhage, will be apparent to all.

100. We might enter more at length into the treatment of excessive and consequently highly dangerous cases of menorrhagia; but as some authors think that instances of this latter kind, in which the blood poured out coagulates, ought to be regarded as hæmorrhages from the uterus, rather than menorrhagia; and, as we intend fully to describe the treatment to be observed in uterine hæmorrhage, we shall refer our readers to that part of this treatise for the desired information; and shall conclude the remarks on profuse menstruation by a review of the measures to be adopted, in the intervals of the menstrual periods, to prevent the return of the disease. To effect this purpose a mild and nutritious diet, country or rather the sea air, chalybeate water, and the injection of astringent washes into the vagina, will do much. In addition, all painful exertion, or rather every degree of exercise which exceeds the limits of comfort, by inducing fatigue, should be avoided. We must however bear in mind that in cases where the weakness giving rise to menorrhagia is local, not constitutional, we incur some degree of hazard by the employment of general tonic measures, as we are told that by these means we increase the strength of both parts at the same time. We confess we are not very fearful on this point, if due care be displayed in the treatment of the local debility: let cold astringent injections be perseveringly thrown into the vagina, at the same time allowing the general health every opportunity to recruit, and we feel assured that greater benefit will be obtained than if we had carried forward the treatment by a preponderance in favor of local, to the disregard of constitutional remedies.

101. It is scarcely necessary to remark that long continued menorrhagic discharge gives rise to very complicated affections of the general health, in which almost every organ seems to suffer. Here we may exhibit, having previously regulated the state of the bowels, the sulphate of iron, or the sulphate of quinine, in small repeated doses.

102. *Dysmenorrhœa, or painful menstruation.*—This disease is not of very unfrequent occurrence, especially in cities and large towns, where dissipated and irregular habits so generally prevail. If the menstruation be painful it is generally very sparing, at least for the first two or three days, till by the influence of remedies the cause of obstruction is removed. It is most probably dependent on an imperfect or partially established catamenial action; an opinion supported by the beneficial results of mild emmenagogues; and by a knowledge of the way in which the discharge comes on. The approach to the period is characterised by continued and severe pain in the lumbar, dorsal, and pelvic regions, which is tardily followed by a very slight flow of the secretion; this, as we have just now observed, continues imperfectly for the first few days and, as the discharge increases in quantity, the pain becomes less severe, till at last it is scarcely regarded. We attended a lady three years ago, in dysmenorrhœa, where there was superadded to the disease the most violent spasm of the intestines we ever recollect to have seen; it was not uncommon for her to remain delirious for some hours from the violence of the pain. Opium, sinapisms, and the warm bath, gave slight and temporary relief: but it was not till the employment of the ammoniacal injection with opium, continued through many periods, that she was permanently improved. This patient resides in the West of England, and we have lately heard that her menstruation is performed with very trifling pain, and so abundant in quantity as to free her from congestion about the head, formerly one of her most distressing symptons. The remedies we have now mentioned are to be resorted to during the attack, and the opium is particularly beneficial, if combined with ipecacuanha, and given in such doses in tepid diluents as to produce perspiration.

The interference with the general health must be treated on general principles, ever taking care to prevent any accumulation in the alimentary canal, by the judicious exhibition of laxatives.

103. Having concluded our general remarks, we subjoin the following observations on menstruation.

104. All the common circumstances, as Dr. Denman observes, attending menstruation, have been well and fully described by various authors; but having very often observed a substance expelled with the menstrual discharge, which has hitherto escaped notice, and apprehending the

knowledge of this substance may be of use in practice, he felt it incumbent to describe it.

105. In the examination of that discharge, for the purpose of investigating the state of the uterus, and the discovery of some complaints thereon depending, a membranous substance was often shown me, which was usually considered as the token of an early conception, or as the casual form of coagulated blood. But, on examining this substance with more attention, I constantly found that one surface had a flocky appearance, and the other a smooth one; that it had in all respects the resemblance of that membrane which Ruysch had called the villous, of the formation of which Harvey had given a very curious description, and which the late Dr. Hunter described with his usual precision and called the decidua. To put the matter out of doubt, several years ago I requested the favor of Dr. Baillie to examine some portions of this membrane, and he agreed with me in thinking it an organised membrane, similar in structure to the decidua. As the first cases in which this membrane was discharged were those of women who were married, a doubt arose in my mind whether it was not really a consequence of early conception; but I have lately had the most undoubted proofs that it is sometimes discharged by unmarried women, and may be found previously to and without connubial communication; and that the uterus has occasionally, or constantly in some women, the property of forming it, at, or in the interval between the periods of the menstrual discharges. It seems particularly necessary to establish this fact, as the appearance of the membrane has more than once given rise to erroneous opinions and unjust aspersions. Nor is this the only circumstance in which some women, at each period of menstruation, have symptoms like those which accompany pregnancy or parturition. In every case, in which this membrane has been discharged, the women have menstruated with pain, and the discharge has flowed slowly, and apparently with difficulty, till the membrane was come away, which in some cases has been in small flakes, and in others in pieces equal to the extent of half the cavity of the uterus, or more, of which they retain the shape. I suspect, but my experience does not enable me to decide, that this membrane is expelled in every case of habitually painful menstruation.

106. Morgagni (vide Epist. xlviii. Art. 12) describes this disease very accurately. The membrane, he says, is triangular, corresponding to the shape of the uterine cavity; the inner surface is smooth, and seems as if it contained a fluid; and that it does so I have no doubt, from my own observation; the outer surface is rough and irregular. According to Morgagni, the expulsion is followed by lochial discharge.

107. Dr. Denman supposes that no woman can conceive who is affected with this disease; but some cases, says Mr. Burns, and amongst others that related by Morgagni, are against this opinion. Mercury, bark, chalybeates, myrrh, and injections, have all been tried without much effect. Time in general removes the disease better than medicine, which is only to be advised for the relief of pain, weakness, or any other symptom which may attend or succeed to this state.

PART II.

OF THE GRAVID UTERUS.

108. Having completed the first division of our subject, in which we have endeavoured to present to our readers a practical rather than an elaborate abstract of the obstetric properties of the female pelvis, including the natural and diseased conditions of menstruation:

109. We shall proceed to the description of the gravid uterus, comprising in this section the changes induced in the uterus and its appendages by impregnation, the various uterine products of conception, the doctrine of conception itself, and the diseases of pregnancy, together with its earlier and later signs. Here we shall pursue the same course as in the former part of the treatise, disencumbering the subject as much as possible of all irrelevant and unimportant details, and concentrating the attention of our readers on those facts and symptoms which are independent of controversy, and which lead to useful results in practice.

110. It is scarcely necessary to observe that the whole genital system of the female undergoes most important changes from impregnation; and, in treating of the gravid womb, we shall principally dwell on the alteration in its volume, in its figure, in its structure, in its situation, a d in the action of which it becomes susceptible.

111. The uterus, in its gravid state, contains the ovum, which consists of the fœtus and its appendages, viz. the placenta, the membranes, the funis umbilicalis, and the liquor amnii. It will hence be apparent, on the slightest reflection, that the properties of this viscus, at the close of pregnancy, must differ very widely from those by which it is characterised at its commencement, or during its unimpregnated condition.

Its volume and weight are conspicuously increased; so that the uterus, which before pregnancy attracted no notice from its size, and produced no unpleasant effects from its weight, is now most prominent from its increased volume, and is giving rise to troublesome symptoms solely by its augmented gravidity. Its enlargement is more apparent in the latter than in the earlier months of pregnancy; although this remark is true only with regard to its absolute increase, as in the first month after conception it probably doubles its natural size. It does not go on in this ratio, not being twice as large in the ninth as it is in the eighth month. The uterus increases in every direction during pregnancy, yet all its diameters do not increase in the same proportion in every period, and hence arises its alteration in shape. The longitudinal axis of this viscus increases much more from the third to the sixth than from that to the ninth month; whilst the other dimensions augment much less in the earlier than in the latter periods, when the cavity grows rounder in all parts: not, however, entirely losing that oval figure which is natural to it in the unimpregnated condition.

112. The position of the uterus is much

changed during pregnancy; and it is of great moment to be well informed on this point, as we may be called upon to distinguish between pregnancy and ascites, schirrous or dropsical ovaria, or any other abdominal intumescence; and the right surgical operations for the relief of these morbid conditions will depend on the correctness of our diagnosis.

113. It is not necessary here to enumerate the various marks on a knowledge of which will depend the truth of our opinion. These have been already alluded to, and they will hereafter be dwelt on more fully. The os uteri, at the close of pregnancy, is situated inferiorly and posteriorly, pointing towards the middle of the sacrum; the fundus is anteriorly beyond the point of the ensiform cartilage; having above posteriorly, and at its sides the intestines, and below and in front the bladder when distended. The ascent of the uterus is never directly upwards, but generally inclining a little to one or the other side, and, according to Hamilton, most commonly to the right. Three causes may be adduced as giving rise to conspicuous deviation in the position of the uterus. The relaxed condition of the abdominal parietes, generally if not always increased by child-bearing; the boldness of the lumbar curve, by which the womb is thrown unnaturally forward, and deformity of the pelvis. The accoucheurs of the last century, and especially Deventer, ascribed to the relaxed condition of the abdominal parietes the obliquities, as he termed them, of the uterus, to which he erroneously imputed the interruption of labor; overlooking the two last-mentioned causes, to which he might with propriety have attributed most of the obstacles to parturition.

114. While the uterus is thus altered in its figure, position, and volume, by pregnancy, it does not suffer less change in its composition and development. 'Its fibres not only unfold and lengthen during this state, but they become soft, red, and spongy, till at length we recognise in them all the appearances of muscular organisation.' Blumenbach, and some of the continental anatomists, have denied the muscularity of the uterus, principally from their not being able to discover such structure in its unimpregnated state. We cannot concur in such an opinion. In the mammalia generally the womb is indisputably muscular; and, in the womb of the rabbit, there are two distinct sets of fibres, annular internally, and longitudinal without, the action of which, in a rabbit whose abdomen was opened at the close of pregnancy, we have seen more distinctly than the peristaltic action of the intestines. In the impregnated uterus the muscularity of its structure is obvious, as many preparations in our various museums will testify. Like other structures of the same kind, it is acted on by specific stimuli, the ergot, the distension produced by the child at the full period, the presence of the placenta, and by the accidental remaining behind of a clot of coagulated blood. Allowing these facts their full weight it is, to say the least of it, opposed to the simplicity of nature, so apparent in all her operations, to deny the muscularity of the human uterus, especially when strengthened, as we have already observed, by the established knowledge of its irritability and power of contraction. Anatomists are not agreed as to the regularity of the course of these fibres. Ruysch, and Dr. Hunter in his splendid work on the Gravid Womb, describe them as transverse in the body of the uterus, but forming at the fundus concentric circles around the fallopian tubes.

115. The ligaments of the uterus, the ovaria, and the fallopian tubes, are not, towards the close of gestation, situated as formerly, loose in the pelvis; for the duplicatures of the broad ligament, in which they are contained, are now spread over the womb; and these parts are necessarily confined by the stretched peritonæum. The blood-vessels are much enlarged during pregnancy, especially in the part occupied by the placenta, where some of them are dilated in a surprising degree. The capacity of the veins is so much increased that they have sometimes received the name of sinuses, and, in the part occupied by the placenta, many of them are large enough to receive a goose's quill. Nor is it these vessels alone which are so developed; the lymphatics are much more so when we consider their original diameters. Cruikshank says they become as large as quills, and are so numerous in the latter periods as almost to induce the belief that the uterus is nothing but a composition of these vessels. The nerves participate in this increase of development; and, when we consider the numerous sources of their origin, we cannot wonder at the sympathy of so many parts with the uterus, or at the variety of symptoms produced by the diseases which affect it.

116. There has been much controversy about the increase of thickness in the gravid uterus; some affirming that its thickness was greatly augmented, while others have strenuously denied the fact, and have stated that it is even thinner than in its virgin condition. If its parietes do not preserve all their natural thickness, while it is acquiring a larger capacity, at least they lose so little of it that many authors have thought it remains the same in all periods. We are not aware of any facts which enable us to speak with absolute certainty on this point; as we have seen, in the obstetric museum of Guy's Hospital, four preparations of the pregnant womb, which demonstrate its thickness and thinness in an extraordinary degree.

117. Denman says that, if healthy, it retains its original thickness through the whole period, to whatever degree it may be distended. He also considers this thickness the medium of its strength, by which it is capable of exerting infinitely greater power for the expulsion of its contents than the uterus of any animal. If the womb be increased in thickness there is no practical deduction of importance connected with it; if on the contrary it be extraordinarily attenuated it is evident that especial caution should be employed in the performance of any manual or instrumental operation within its cavity; as rupture and laceration are accidents of not very rare occurrence. The place where the placenta is attached is that where the thickness of the parietes is most considerable, and the vicinity of the orifice is the thinnest part. To

judge as correctly as possible, on this point, our examination should be made when the uterus is in its state of greatest dilatation, or before the waters have passed off; for the thickness will of course increase in proportion to the diminution of its contents.

118. Little need now be said as to the nature of the uterine enlargement; that it is not owing to mere mechanical distension is, we conceive, sufficiently proved by what we have already advanced: we must attribute it to the gradual and increasing development of all the structures entering into the composition of the womb, and also to the very large quantity of blood which is circulating through its vessels. It is accompanied by real growth, and by the accretion of cellular substance.

119. The follicular apparatus about the neck of the womb, as it serves the important purpose of protection to the membranes from any foreign body, is deserving of notice. During the whole period of gestation these glandular follicles secrete a viscid gelatinous fluid, closing the mouth of the uterus, and rendering it impervious after conception. It is from this source that the glairy fluid, at the commencement of labor, denominated show, is principally furnished.

120. Thus pregnancy is not only giving rise to changes in every part of the original structure of the uterus, and which become more apparent as gestation draws towards a close, but at the time of labor we find a new principle superadded, for the purpose of putting a stop or termination to the further ascent and enlargement of this viscus. It is this principle which gives a disposition to the uterus to act upon, and to exclude, whatever is contained in its cavity; and, if any further proof were wanting of its muscularity, the way by which it thus rids itself of its contents would abundantly furnish such testimony. This action has been considered as of two kinds; tonic action, which is equal and constant; and spasmodic contraction, which is sudden and transitory, and is that species of power which is called into exercise by the exigencies of parturition. Perhaps the more simple and correct statement is that which represents both these species of action as the same in their nature, differing only in their degree; this difference being produced by the large volume of contents upon which the womb has to act, and which oppose such various degrees of difficulty and resistance to the completion of its purposes, as to render necessary such contractile efforts as must be attended by spasmodic and painful sensations.

121. Various opinions have been entertained by physiologists as to the precise nature of the uterine action, but we are not aware of their having arrived at any satisfactory result. The original or genuine cause of its action may exist in its structure, form, or properties, or perhaps in some inexplicable impression produced on the uterus by the child. The circumstances of the constitution, as its strength and disposition to act, and more especially the blood, appear to exert an important influence as to the manner in which the effects of uterine action are produced.

122. The prevailing opinion is that which we have already stated, that the action of the muscular fibres of the uterus very nearly resembles that of other parts, and that the pain peculiarly attendant on its exercise arises principally, if not solely, from the obstacles it has to surmount, and which are inseparably connected with human parturition. Amongst the most conspicuous of these obstacles may be enumerated spasm, the firmness of the os uteri, and the resistance of the perineum and vagina. Having now presented a brief, but we hope a sufficiently explicit view of the womb and its contents generally, at the termination of pregnancy, we shall pass on to notice in the same manner the principal circumstances connected with the expulsion of these contents. Immediately after the rupture of the membranes, and the passing off of the waters, a new series of action is commencing in the womb, and the very reverse of that power, which during the period of gestation has been incessantly employed in building up the uterine structure, is now called into exercise to carry back the uterus, as far and as quickly as is consistent with the uniform perfection of nature's operations to its original unimpregnated condition. The same contractile effort which ruptured the membranes, having acquired fresh force by the removal thus far of the obstacles which opposed its exercise, acts with increased power upon the remaining portion of the uterine contents, and soon completes the work of their entire expulsion. It is natural to suppose, what is really the case, that after such extraordinary efforts the whole system, but more especially the uterus, remains for some little time torpid and exhausted; this condition, if the labor has been favorable, as to its severity and continuance, is but of short duration; and on examination of the uterine region, very soon after entire delivery, we are surprised at the collapse which the uterus has undergone: for instead of a womb considerably larger than the adult head, occupying the greater part of the abdominal region, we find a hard, round, firm body, scarcely as large as the fœtal cranium, occupying a situation a little above the ossa pubis. This, although the most prominent and desirable event, and that which is most frequently occurring after a well managed labor, is not the only one which demands our strict and anxious attention. The vagina, whose parietes have been greatly distended by the passage of the child, is longer in recovering so much of its original dimensions as places it beyond the reach of any untoward accident. Its laxity is such as to admit very easily of insertion, more especially, if any injudicious attempts have been made to extract the placenta, by pulling at the funis. Inversion of the uterus may be produced by the same cause, and, whenever any degree either of instrumental or manual force has been employed in the labor, it is highly important that we should satisfactorily assure ourselves that all is right. This is best effected by laying the hand above the symphysis pubis, not removing it till we have grasped and distinctly felt the uterus.

123. Another method may be practised with extreme caution, which consists in passing up two or three fingers into the vagina; when, if there be any great degree of inversion, either

of the vagina or uterus, it will easily be ascertained. We would here deprecate the indiscriminate practice of thrusting the whole hand into the uterus, on slight occasions, as replete with danger of the worst kind; nothing justifies the introduction of the hand, excepting cases of extreme hazard and difficulty. It will be sufficiently evident, after what has been already stated, as to the great enlargement or development of all the structures of the uterus, that, even where nature's intentions with regard to the contraction of this viscus shall have been fully answered, its blood-vessels must necessarily remain for some time of large capacity. The vessels which during pregnancy have been shooting from the uterus into the placenta, are, as we have already said, of very large size, and it is only by the contraction of the muscular fibre of the uterus around them, which ties them up, as by a ligature, that they are rendered secure. Hence the increasingly great importance of procuring this contracted state of uterus, which is without doubt the only permanent safeguard against hæmorrhage. External pressure, carried to the extent of griping the uterus, with the administration of cold, either externally or internally, or both, are amongst the most efficient measures. We need scarcely add that any circumstance calculated to give impulse to the circulation, whether of a mental or physical kind, ought most sedulously to be avoided.

124. The next object of our enquiry will be the womb during gestation; and here we shall dwell a little more in detail on those circumstances which by their gradual development have produced the results already described. Though we do not perceive very clearly what passes in the uterus at the instant of conception, and although we are not very sensible of its enlargement in the first months of pregnancy, it may be assumed, as a fact beyond all controversy, that the womb does possess this principle of gradual growth; and so large does it become, in the latter periods, that our greatest difficulty is in conceiving how its vast increase of size has been accomplished. For the first two or three months the uterus suffers little alteration in its shape, its cavity remaining, as before impregnation, pretty much of a triangular figure. Its weight, however, is increased after conception; and one of the first effects produced is its subsidence rather lower into the vagina, the shortness of which has been considered one of the equivocal signs of pregnancy. The uterus, thus confined within the bony cavity of the pelvis, has a natural tendency from its increasing bulk to gravitate downwards, which satisfactorily accounts for many of the distressing and troublesome symptoms of which women at that period complain. The fundus uteri is the part first distended; and, notwithstanding the increased weight, after a certain time begins to ascend. About the fourth month the uterus may be manifestly felt above the brim by applying the hand to the hypogastric region. In the fifth it is midway between the pubes and navel; in the sixth it is a little below, and in the seventh a little above the navel. In the eighth it is half way between the scrobiculus cordis and umbilicus; at the ninth it has reached the ensiform cartilage or scrobiculus cordis; and, at the commencement of labor, it is frequently not much higher than during the seventh month. In the second month the uterus is enlarged in every part, without much change of shape; at the end of the third month it generally measures from the mouth to the fundus above five inches, one of which belongs to the cervix; in the fourth it measures five inches from the fundus to the beginning of the neck; in the fifth about six inches from the cervix to the fundus. In two months more it measures eight inches; and in the ninth month it generally measures ten or twelve inches, and is oviform in its shape.

125. In the fifth month the cervix uteri begins to stretch, and one quarter of its length has become distended. In another month one half of the cervix is suffering this change; and in the eighth the neck is completely effaced, and its orifice is as high as the brim of the pelvis.

126. The changes of the os uteri are principally effected during the ninth month, when its lips shorten, and sometimes disappear, although more generally they continue to project a little until labor commences. The mucous follicles too become more developed, and they pour out a fluid which serves the purpose of lubricating the parts and giving the first pretty certain indication of labor.

127. The *umbilical cord* is the channel of communication between the mother and the child, and is passing from the abdomen of the latter to the placenta, into which it is generally inserted about one-third from its edge. It consists of two arteries, continuations of the arteriæ hypogastricæ, and one vein protected by a membranous coat, the space between the vessels being filled up by a glutinous nucleus. It is worthy of remark that neither absorbents nor nerves enter into the composition either of the funis or placenta, and that the funis under various modifications is found not only in oviparous and viviparous animals, but also in plants. The course of these vessels is not always straight; they run sometimes in a spiral direction, the arteries coiling round the vein, both chorion and amnion entering into the composition of the sheath, 'the chorion adhering firmly to the cord every where, but the amnion not adhering to the chorion; it is not even in contact with it at the placental extremity, but forms there a slight expansion, which from its shape has been called by Albinus the processus infundibuliformis.' *Burns*, p. 143.

128. For some weeks after conception, if the embryo be examined, no trace of the umbilical cord can be perceived, the abdomen of the child firmly adhering to that which afterwards becomes the placenta. This bond of union, by its subsequent extension, is converted into the funis umbilicalis, the length and thickness of which are not always in proportion to the size of the fœtus. The length of the cord varies greatly in some cases, being double the length it is in others; and, in a twin labor we once attended, it was so preternaturally short as scarcely to allow sufficient space for the application of the ligatures. Its average length is two feet, although the range of variation is from six inches to four feet.

129. The funis is sometimes knotted, and in a case we lately attended we counted five distinct knots, but there was no diminution in the size or vital powers of the child. The varicose state of these vessels is said sometimes to interfere with the circulation and growth of the child, and even to destroy it altogether: this we do not doubt, but we have frequently met with this varicose state of the cord entirely unaccompanied by these circumstances. Sometimes by the rupture of the vessels blood is poured into the uterus, exciting pain and a sense of distension.

130. This, however, is only known when the membranes are ruptured by the discharge of coagula. If the fœtal and maternal portions should communicate, the mother is weakened and may even faint, and in every instance the child suffers but does not always die. *Vide Bandelocque l'Art.*, note to section 1084.

131. In a case which occurred to us some time since, where the cord was very much twisted round the neck, body, and thighs of the child, we divided it in preference to any attempt at untwisting. The latter measure we feel convinced, had it been ever so carefully performed, would have ruptured the funis. The shoulders of the child had here been delayed twenty minutes after the expulsion of the head, and we are persuaded the birth could not have occurred, unless the placenta had accompanied or immediately followed the child; or that such pressure, prior to its expulsion, would have been made on the cord as to have destroyed its life, if the funis had not been divided; of course the fœtal portion of the funis was instantly secured by ligature, and the shoulders were seen in the world. Burns, in a quotation from M. Anel, says the cord may, by a fall or violent concussion of the body, be torn at a very early period of gestation. In this case the child dies, but is not always immediately expelled. It may be retained for several weeks; afterwards the ovum is thrown off, like a confused mass, enclosing a fœtus, corresponding in size to the period when the accident happened. The cord may be filled with hydatids.

132. Mauriceau proposed, where the cord was unusually thick, that two ligatures instead of one should be applied on the portion which remains attached to the child, as it may so happen that by the shrinking of the cord a fatal hæmorrhage may ensue.

133. *Placenta.*—There can be no doubt, notwithstanding our ignorance of the precise manner in which the functions of the placenta are performed, that it exerts a most important influence on the vitality of the fœtus. Changes, analogous in some degree to respiration, are required by the fœtal blood, and these it receives by its circulation through the placenta; and, although we cannot trace the connexion between its maternal and fœtal portions, yet we know, if the placenta be injured by the rupture of the vessels passing between its inner surface and the womb, the child being deprived of its proper blood would perish, while the mother might experience no very serious injury.

134. The human placenta is a circular flat body, about six inches in diameter, and one in thickness. In quibusdam placenta reperitur crassior, amplior, et sanguine abundantior.—Harv. The centre is generally its thickest part, from which to its circumference it is gradually attenuated, so as to lose itself in the involucra or membranes.

135. The shape of the placenta varies, being sometimes oblong, and at others curiously lobulated; and we lately met with an example of the termination of the umbilical cord in the membranes at a very short distance from the placenta. The human placenta appears to consist of blood vessels and a cellular web (placentæ substantia non constat glandulis sed mirè vasculosa est.—Ruysch), but possessing neither absorbents nor nerves. Dr. Haighton used to consider it as made up of three systems, the maternal or cellular, in which the arteries terminate, and the veins commence; the fœtal or vascular; and the intermediate, consisting of pulpy or cellular substance, and in which, if they exist, are to be found the communicating vessels between the maternal and fœtal portions. If we throw ever so fine an injection into the umbilical arteries of the fœtus, we shall thereby distend a considerable part of the placenta, but we shall find that the vessels of the maternal portion receive no part of the injection. On the contrary, if we inject from the uterine arteries, we shall again distend the placenta, but we shall find the umbilical vessels and their ramifications perfectly uninfluenced. Hence we may infer the separation of the two portions of this viscus. It is also admitted that the blood of the fœtus, with regard to its formation, increase, and circulation, is totally unconnected with, and independent of the parent, except that the matter by which the blood of the fœtus is formed must be derived from the parent. Abundè me demonstraturum arbitror, viviparorum quoque fœtum, dum adhuc in utero continetur, non matris sanguine nutriri spirituque ejus vegetari, sed animo viribusque suis frui, ut pullus in ovo solet proprioque sanguine gaudere. *Harv. Exercitat.* xxxiv.

136. Thus in all probability, analogous to the adult circulation through the lungs, the blood fitted for the fœtal circulation is deposited by the uterine arteries in minute vessels or cells, situated in the intermediate portion of the placenta, where the ramifications of the umbilical vein, either by a secretory process or by actual absorption of some of its finer parts, take up that which is necessary to the well-being of the fœtus, and convey it along the funis to its ultimate destination. In like manner, when the circulating fluid of the fœtus requires any change, it is returned by the umbilical arteries of the funis to the cells of the placenta, whence the placental veins reconvey it to the general circulation of the parent. From all this it appears that Harvey was not far from the truth when he promulgated the opinion of the placenta performing the office of a gland, and secreting from the blood brought by the maternal arteries that which is necessary for the nourishment of the fœtus, much after the manner of the breasts and the liver. Ego itaque placentæ et caruncularum tale munus existimo, quale hepati atque mammis vulgo tribuitur: hepar nempe chylum ex intestinis haustum cor-

pori alendo ulterius præparat: et placentæ similiter succum alibilem à matre provenientem nutriendo fœtui porro concoquit.—*Harvey de Placentâ.*

137. *The membranes.*—Great diversity of opinion has obtained in relation to the number and structure of the membranes, which, together with the placenta, contain the fœtus, the navel string, and the liquor amnii. This has principally arisen from the different periods of gestation when they were examined; and from the confusion of terms and the variety of descriptions which have been annexed to them. It does not appear very important, for practical purposes, to enter into a lengthened examination of the time when the membranes become consolidated or adherent one to the other; and we shall, therefore, describe them as they are found in the latter months of pregnancy; consisting of the amnion, and true chorion, and the decidua or spongy chorion; which last is furnished entirely by the uterus, and serves for its connexion with the vessels of the fœtus.

138. The ovum, says Mr. Burns, when it descends into the uterus, consists of two membranes, one within the other, having very transparent jelly interposed between them; but in process of time the innermost, which is called the amnion, grows so much faster than the outermost, called the chorion, that it comes in contact with it, or at least has only a thin layer of jelly interposed. The amnion is transparent, and thinner than either of the two other membranes, although, at the termination of pregnancy, it is stronger than either; it adheres to the internal surface of the chorion and placenta, and, being reflected over the funis, it terminates at the umbilicus.

The decidua, as we have already observed, is provided entirely by the uterus; it is not a covering of the fœtus, but the lining of the womb falling off after delivery, and generally discharged with the lochia. Ruysch remarks that these membranes, in the advanced state of pregnancy, cohere slightly to each other; though, in some ova, there is a considerable quantity of fluid collected between them, which, being discharged when one of the outer membranes is broken, forms one of the circumstances which have been distinguished by the name of by or false waters. Haller supposed that the decidua was formed by the uterine vessels. Dr. Hunter thought the decidua originated in coagulable lymph. John Hunter attributed its formation to coagulated blood, forming a pulpy substance on the inner surface of the uterus.

139. Burns says that the decidua consists of two layers, one is highly vascular, proceeding directly from the uterus; the other, which is most probably formed by these vessels, is more fibrous and gelatinous; and, when this is removed, the primary vessels or outer layer may be seen like a fine efflorescence covering the surface of the uterus. In some cases the decidua extends a little into the fallopian tubes; in other instances it does not. In no case does the cervix form decidua. It is only produced by the fundus and body of the womb, and immediately above the cervix the decidua stretches across so as to form a circumscribed bag within the uterus. In some instances we have observed this continuation to be wanting, although the parts were opened with ease. In all other circumstances these uteri resembled those where the decidua was continued across; but perhaps, notwithstanding this, there may have been a difference of two or three days in the period of impregnation occasioning this variation. In every case the decidua, consisting of two layers, is completely formed before the ovum descends. When the embryo passes down through the tube it is stopped, when it reaches the uterus, by the inner layer, which goes across the aperture of the tube, and thus would be prevented from falling into the cavity of the uterus, even were it quite loose and unattached. By the growth of the embryo, and the enlargement of the membranes, this layer is distended, and made to encroach upon the cavity of the uterus, or, more correctly speaking, it grows with the ovum. This distension or growth gradually increases, until at last the whole of the cavity of the uterus is filled up, and the protruded portion of the inner layer of the decidua comes in contact with that portion of itself which remains attached to the outer layer. We find, then, that the inner layer is turned down and covers the chorion, from which circumstance it has been called the reflected decidua. Thus we see that wherever the ovum descends it is encircled by a vascular covering from the uterus, which unites in every point with those shaggy vessels which sprouted from the chorion, and which made what was called the spongy chorion. One part of these vessels forms the placenta, and the rest gradually disappear, leaving the chorion covered by the decidua. The liquor amnii, or the waters, as they are denominated in labor, are generally transparent, though they are sometimes of a dusky brown color. They are contained, as the name implies, within the bag of the amnion, and, when analysed, they yield principally water, with a small proportion of mucus, saline matter, and earth. This fluid serves several important purposes in pregnancy; it furnishes a yielding and easy support for the fœtus in utero in the early months; it protects the fœtus from any mechanical or spasmodic contractions of the womb; and in the latter months it equally preserves the uterus from the plunging and kicking of the child. It allows of easy motion within the uterine cavity, gently distending it, and preventing any morbid adhesion of its parts. In the time of parturition every practical accoucheur is aware how much more quickly the os uteri is dilated by the membranes forced down in the form of a cone than by any part of the child's body.

On Conception.

140. We do not intend to lay before our readers even a small part of what has been said and written on this wonderful and difficult subject; but, as a treatise on obstetric science would be incomplete without a slight view of the different opinions respecting generation, we shall, as briefly as possible, detail some of the theories which have prevailed in the different ages of the world, premising our obligation to Dr. Denman for the materials of th

sketch. With him we believe that the first part of the process by which primordial existence is established, from the minuteness and complication of the objects to be described, and, from the retirement of the attending circumstances, is probably involved in too much obscurity to be discovered.

141. In reference to this subject we cannot deny ourselves the pleasure of quoting literally the following passage from Denman's Introduction to the Practice of Midwifery, p. 105:—'Through all nature there is not found a single body which consists of materials lying in confusion. However small, and apparently insignificant, every particle exhibits proof of the majesty and wisdom of God; and it may be presumed that the minutest elementary parts of every substance are originally composed and wrought up in the most regular order into what is called form; yet, in mineral substances, it is a form so immerged in matter, that it is ever restrained from the acquisition of the excellence of a living body, unless there be a previous destruction of its present form; but the more refined the matter the more perfect is the form, and the more perfect the form the more exquisite are the properties. Hence the common observation seems to have been made of the encroachment, as it may be called, of one order of natural bodies upon another; of the near accession of the finest minerals to the lowest vegetables, and of the first vegetables to the lowest animals, in such a manner that they can scarcely be distinguished.'

142. Impregnation may be defined that function whereby the seminal fluid, applied to the female genital organs, excites the various generative actions, thus ultimately producing the fœtus. Pythagoras supposed that, from the brain and nerves of the male, a moist vapor descended in the act of coition, from which similar parts of the embryo were formed; the grosser parts were composed of the blood and humors contained in the uterus, and, according to the laws of harmony, seven, nine, or ten months were required for the perfection of the fœtus.

143. Empedocles thought that some parts of an embryo were contained in the semen of the male and others in that of the female, and that, by the mixture, the embryo was formed. He was likewise of opinion that the desire of procreation originated in the natural tendency of the separated parts to be united.

144. Hippocrates approached very nearly to this view of the subject, maintaining that conception took place in the cavity of the uterus by the admixture of the male and female semen; both of which contained the organic principles of the embryo.

145. Aristotle, forgetting that menstruation is not common to all animals, who nevertheless propagate themselves, denied the existence of semen in the female, imagining that the material parts of the embryo were formed by the menstruous secretion, and that the semen of the male impressed upon them, when formed, the principle of life, by which the embryo was brought to perfection.

146. Galen believed that the embryo was produced from the male, but that it obtained nourishment from the female.

147. The illustrious Harvey, whose researches on generation occupied a considerable part of his life, seems to have been fully aware of the almost impenetrable mystery in which the process was involved; for after detailing many observations, the results of his sagacious and persevering enquiry, he explains his opinion on conception, by an allusion to the almost incomprehensible properties of the magnet; he tells us that as iron, by friction with a magnet, becomes possessed of magnetic properties, so the uterus, by the act of coition, acquires a plastic power of conceiving an embryo, in a manner similar to that by which the brain is capable of apprehending and thinking. Videtur sanè fæmina, post tactum in coitu spermaticum, eodem modo affici, nulloque sensibili corporeo agente prolifica fieri, quò ferrum a magnete tactum, hujus statim vi dotatur, aliaque ferramenta ad se allicit.—*Harv. Exercitat. de Concept.*

148. The opinion of Hamme, adopted by Leuwenhoeck, obtained great celebrity and applause, as the facts on which it rested were supposed to be demonstrated by the microscope. He asserted that in the semen of all male animals there was an infinite number of animalculæ, in each of which were contained the perfect rudiments of a future animal of the same kind; and that these required no other assistance from the female but a proper bed for their habitation, and nutriment for their expansion. This opinion was soon met by the observation of mixed generation, as in the case of a hybrid or mule, which, being procreated by two animals of different species, partakes in an equal degree of the nature and likeness of the male and female parent. This seems an unanswerable refutation of the doctrine, and it is now universally believed that Leuwenhoeck's animalculæ are nothing more than parts fitted for organisation.

149. At length the aid of chemistry was brought to bear upon the subject. The chemists presumed that the male semen was of an acid and the female of an alkaline quality, from the mixture of which an effervescence arose. From some particles which subsided, on the conclusion of the effervescence, they fancied that the embryo was formed, the fluid parts becoming the waters of the ovum.

150. Dr. Blundell, in some published 'experiments on a few controverted points respecting the physiology of generation,' says that among the various questions which have been raised, respecting the generation of animals, there is one as yet undecided; which has not, perhaps, been hitherto investigated with all the care it deserves. It may be demonstrated that, in this curious process, the male furnishes the semen, and the female the rudiments; but whether these two substances must have access to each other, in order that the young animal may be formed, is a question which still admits of dispute. Notwithstanding the labors of physiologists, we are not as yet in possession of any regular system of experiments, proving that the semen must have access to the rudiments in those forms of brute generation which most nearly resemble our own. In the present state of our knowledge the result of this position seems, at least, not improbable, as the experiments of Dr. Haighton have shewn that

evidences of generation may be produced in the ovaries, although the semen has been excluded previously to sexual intercourse by the closure of the fallopian tube.

151. On a review of the results of his experiments, Dr. Blundell thinks it not improbable that, for the completion of generation, the semen must have access to the rudiments, and yet that, notwithstanding the necessity of these approaches for its completion, the process to a certain extent may be accomplished without them. These are the two leading propositions it has been his endeavour to establish: at the same time he has further attempted to show that the corpus luteum is not a proof of genuine impregnation; that the semen, at least occasionally, penetrates as far as the ovaries; and that, however copiously this fluid may be absorbed into the vessels, it is incapable of giving rise, by any impression there, to the complete circle of the generative actions.

152. *Sterility.*—Sterility may depend upon many causes; but the chief are, we think, too early marriage, ill health, too frequent sexual intercourse and dysmenorrhœa. We have frequently observed that very young married females have not had children, and that a deranged state of the female health has prevented conception, which has taken place where the health has been restored. The effect of frequent intercourse in inducing sterility is obvious from the case of prostitutes, in whom it is said, the fallopian tubes frequently contract adhesions with the contiguous parts of the peritonæum; and the influence of an opposite state of things is deducible from the fact of the prolific results of the marriages of old men with young wives. Dysmenorrhœa, menorrhagia, and the formation and evolution of a false membrane from the internal surface of the uterus, are frequently attended by sterility. In one lady there was dysmenorrhœa, with a profuse flow of the catamenia and of coagula for ten years of marriage, and then conception took place; but at this very time the uterus itself was diseased, with morbid growths and partial suppurations formed in its substance, of which the patient died a few days after delivery. This subject is altogether a very interesting one; but it requires fresh investigation. To restore the general health—to limit the frequency of intercourse—and, in cases of dysmenorrhœa, a mercurial course, offer the greatest chances of success in the removal of this evil.

Of the Signs and Diseases of Pregnancy.

153. It is to be expected that so important an organ as the uterus, on the occurrence of any great change in its condition, should evidence such change by indications in other parts of the body. The law of sympathy is one of universal prevalence, and the uterus may fairly be considered the great centre of this influence in the female system. We have already seen that the perfect development of the uterus, or the establishment of that function which capacitates it for conception, is attended by many remarkable consequences, and in pregnancy these effects are not less astonishing: there is scarcely any part or viscus, there is scarcely any action throughout the whole system, which is not influenced in a greater or less degree by impregnation.

154. These changes have naturally excited much attention, not only from their furnishing proof that conception had occurred, but also from their originating symptoms which, if not controlled, would in many instances induce an abortive result of the generative action. Hence it is that medical writers have elaborately investigated these circumstances, and with the signs of pregnancy have generally dwelt at length on these changes, which they have denominated its diseases.

155. It is evident that the term disease, in this use of it, requires some qualification. We do not attach the same meaning to it as in affections independent of pregnancy; but, as some of the disordered actions of this state are so trivial as to be regarded merely as signs of its existence, so there are others, especially in the more advanced periods, which require judicious medical aid. We shall here adopt the common division, and shall class the affections of this state under two heads, the symptoms of early, and the symptoms and diseases of more advanced pregnancy: regarding the quickening as the point of separation between the two By this arrangement we follow out our own view of the subject, that the changes immediately consequent on conception rarely demand the appellation of disease; while those of the latter class, however naturally connected with the gravid state, do sometimes require the most decided and prompt treatment. It must, however, be remarked that, as in fever there are scarcely two cases which exactly resemble each other, so in pregnancy there is the utmost diversity; some women, if they suffer at all, complain only of the slightest inconvenience; while others regard the time of gestation as replete with indisposition and miserable sensations. In some instances there is so little sympathy or consent of parts that pregnancy seems to proceed independently of any other organ; while in others every function of the body partakes of the irritability which impregnation has induced. And, although the division we have adopted is generally correct, we do find that some women are so affected, by the least increase in the weight of the uterus, that the symptoms arising from pressure on the neighbouring parts appear in the early months. On the whole the gravid state is not necessarily one of disease; it is an altered condition, productive of less or greater inconvenience in proportion to the observance or neglect of a simple and natural course of life. If, because of conception, healthy exercise be abandoned, and the ordinary occupations of life be laid aside, while the same quantity of nutritive and perhaps stimulant food continues to be taken, we have here a cause of disease which, independently of pregnancy, would induce the most injurious effects. And, while we are aware of the necessity which sometimes exists in certain periods of this state for quietude and repose, we cannot forbear the expression of our opinion, that a moderate degree of activity will conduce not only to less inconvenience during gestation itself, but to an easier labor. The example of women of the lower classes, who follow laborious occupations in the open air, without scarcely any regard to pregnancy, is decidedly in favor of this conclusion. Nor can we divest ourselves of the

belief, that the favorable or unfavorable circumstances of the mother, during pregnancy, more especially as it regards her active or sedentary and luxurious mode of life, do very often materially influence the health and vigor of her offspring? We do not assert this as an established fact, but we have been led to a conclusion of the kind from observing, in a few instances, where we knew the mother to have been remarkably inactive and indolent during her pregnancy, that the children were torpid and sluggish in the performance of all their functions; more especially in the healthy evacuations of the contents of the intestines. In two instances, occurring in the same family, we thought we could perceive great tendency to hydrocephalus from this cause.

156. *Signs of the early months.*—The suppression of the menses is generally the first circumstance which leads women to suspect pregnancy. It is undoubtedly true that amenorrhœa may, and frequently does, arise from other causes; but, as a single sign, we think it of great value. Dr. Denman affirms that he has never known a pregnant woman menstruate; and in this opinion we agree, although instances have occurred to us where there have been, in the early months, several returns of a sanguineous discharge, thrown off in clots and coagulating, similar to the menses in color, and arising, perhaps, from the upper part of the vagina and about the cervix uteri.

157. These discharges have not observed any regular intervals; they were not ushered in by any symptoms characteristic of approaching menstruation; nor did they continue beyond the third or fourth month. The discharges of a later period may, we conceive, be explained on other grounds.

158. We have lately been called upon for an opinion in some cases of doubtful pregnancy; and though there was in all of them abdominal and mammary enlargement, and in others more or less of the various symptoms of this state, in none was there suppression of the menses. For ourselves we should feel more confident of the existence of pregnancy from an entire suppression of the menses, all other signs, with the exception of abdominal increase, being absent, than we should from the united assemblage of all the other indications, if the menstrual secretion continued with its accustomed regularity.

159. Cardialgia, nausea, and vomiting, are almost constantly attendant on conception; there are instances, and we have known several, where there is scarcely a sensation of sickness throughout the whole period; these are, however, very rare, as it much more constantly happens that during the whole of the early months, immediately on getting out of bed, there is a vomiting of a glairy, and sometimes of a bilious, fluid. Puzos considered vomiting as very salutary; and Denman says, if it should not be very violent, and if it occur only in the early part of the day, it is generally found to be serviceable by exerting a more vigorous action of the uterus, and by bringing the stomach into a better state; for the vomiting of pregnant women is not always a mere effort of straining, or a discharge of the food and common humors of the stomach. The matter evacuated sometimes shows a very disturbed state of the stomach, or a morbid secretion of such a kind as to be offensive to the stomach itself; and besides correcting or evacuating the offending humors, it is necessary that we use our endeavours to change or to appease the present action before the indication to vomit be suppressed. We know not how far vomiting may be beneficial in this state; it certainly does occasionally relieve the stomach from an accumulation of disordered secretion, and thus far is of service; if, however, it should continue to the later months, when the abdomen is large, and its parietes distended, we shall hear very frequent complaints of the straining and spasm to which it gives rise. At this time, as well as earlier, it will be right to attempt its mitigation by the various remedies usually employed for this purpose. The application of leeches to the pit of the stomach, of a small blister, or of an opiate plaster, with an additional quantity of this substance in its composition, or of brandy and opium in a liquid form, all being externally employed, will frequently produce great relief. One grain, or a half, of solid opium, we have frequently given with most decided advantage; and in the latter periods, when the head sympathises in the disturbance, it may be necessary to take away blood from the arm or from the back of the neck; mild aperients and laxatives must be exhibited. It is deserving of notice that the vomiting generally comes on when the patient changes from the lying to the erect position; and it is frequently useful to maintain for some little time the recumbent posture. We lately attended a lady who was much distressed by heart-burn; and, after going through the whole round of remedies, she commenced taking prepared chalk, and through several pregnancies consumed an ounce of it every two or three days. It had this additional advantage, that it not only relieved the heart-burn, but preserved the bowels in an invariably aperient and comfortable state. It is manifest that these affections are only important as signs of pregnancy when they concur with the whole series of indications appertaining to this state; for no one would presume a woman to be pregnant, in the absence of other proofs, merely because she was sick and vomited. Loss of appetite accompanies pregnancy, but it is a sign on which evidently no dependence can be placed. Pregnancy is often accompanied by a continual tendency to febrile excitement, the pulse is increased, the palms of the hands and the cheeks are not unfrequently flushed, and emaciation and irritability of manner are the result. If any inflammatory disease should occur in pregnancy, and even independently of such circumstance, the blood, when drawn, will have a sizy appearance: its constituent principles being slightly altered.

160. Great stress has been laid on the enlargement of the mammæ, and, if it be accompanied with tenderness, flying pains, and a secretion of milk, it is a very satisfactory sign. It must, indeed, be recollected, that the increased enlargement of the breasts may arise from adeps as well as pregnancy.

161. If it be merely an accretion of cellular substance, or fat, it will have a soft cushiony feel; if it be originating from pregnancy it will

have a glandular, rather knotted, and uneven character.

162. The areola has been regarded almost as an infallible sign in first pregnancies. We have known three instances where it was increased in breadth, decidedly darkened in color, and where there was slight secretion from its surface, without the existence of pregnancy. If it concur with the other indications, it is a valuable auxiliary corroboration.

163. Having now described those changes which almost invariably attend early pregnancy, we shall briefly notice some anomalous and occasional affections, arising from peculiarity of constitution, such peculiarity being excited into activity by gestation.

164. Frightful dreams are, in some individuals, a very good diagnostic sign; and Dr. Haighton used to relate the case of a lady, under Dr. Lowder's care, who was compelled to hire a nurse to awake her when she was very much discomposed in countenance. We occasionally attend a lady, who invariably knows herself to be pregnant, by pain in the teeth; and many women unerringly arrive at the same conclusion, from the existence of painful sensations in unusual parts, as the toes, fingers, ears, &c.

165. We may remark here that the anomalous signs are not very valuable in first cases, and for this reason, that, not having been previously pregnant, a patient cannot tell whence they arise, or with what state of system they are connected. We have before observed that pregnancy is not a morbid, but an altered state, and plethora or increase of the circulating fluid may be enumerated amongst the causes giving rise to some of the diseases of pregnancy. There is one affection, probably arising from this cause, which is very distressing, although happily not very common, we mean the prurigo pudendorum muliebrium. We are aware that women are subject to this disease independently of impregnation; and we mention this fact the more willingly, from having seen two cases, where conception seemed to have been prevented by its continuance; at all events, it occurred immediately on its cure.

166. The most interesting case occurred in a lady of twenty-six, who had been married five years, and had menstruated regularly during that time. For the last three years she had suffered so acutely from prurigo as to render connubial intercourse impossible. She had followed almost every professional opinion, and every remedy seemed to have been tried unsuccessfully. We put her on a gentle mercurial course, there not being the slightest reason for suspecting any venereal taint; and the affection of the gums was kept up in a slight degree for two months. At the end of this period she was so much improved as to disregard the prurigo, and in another month she became pregnant. The child when born was healthy and strong.

167. Irritability of a nervous and hysterical kind is frequently appearing in pregnancy; it will not be relieved by the abstraction of blood; mild aperients may be given; but when it occurs, as is generally the case, with women of spare and delicate habits, calumba bark and valerian, or any stomachic, given in the form of infusion, will do good. Women, when but little advanced in pregnancy, often complain of inability to walk, accompanied by pain in making water, and a discharge from the vagina, which last, as it may be satisfactorily attributed to pregnancy, ought not hastily to be considered venereal. In cases of suppression of urine Dr. Haighton used to recommend that females should be instructed to relieve themselves, by passing up the finger to the os uteri, raising it up, and thus taking off the mechanical pressure from the womb; and if, in addition to this, they hold their breath, and force down, the urine will often be discharged.

168. *Retroversion of the uterus* used to be regarded with extreme apprehension, and, were we to judge from what has been written respecting it, we should think it an occurrence of the most dangerous kind. The fears which were formerly indulged are considerably modified; it being now well known, that in many instances the timely and continued introduction of the catheter will suffice for its removal; and even where this is not the case, if other circumstances are favorable, it may be allowed to continue for some time without fear of injury. We do not urge these remarks as an apology for ignorance and inattention, but rather to allay any undue excitement either in the practitioner or the patient, and to prevent any unnecessary and meddlesome interference, which might, by producing abortion, originate a mischief worse than the original affection. Retroversion consists in an alteration of the position of the womb; and, for the first accurate description of the change which the uterus suffers, we are in this country indebted to Dr. Hunter, in 1759, Gregoire and Levret having previously written upon it.

169. If the pelvis be of the usual size, it may occur in the third or fourth month, and, if rather more capacious than common, as late as the fifth. The attention of the patient is first excited by difficulty in passing the urine; and by tenesmic sensations in emptying the rectum. If the retroversion be complete we shall, on examination, discover a tumor formed by the fundus uteri, between the vagina and the rectum; and the os uteri, if felt at all, will be found turned upwards and forwards towards the pubes. If an examination be made, per anum, the fundus uteri will be ascertained forcing the rectum into the hollow of the sacrum; and, if the finger of the other hand be in the vagina at the same time, it is not difficult to determine that the uterine tumor is confined between the rectum and the vagina.

170. Retention of urine is the most common cause of retroversion (Dr. Denman's Introduction to Midwifery, p. 78); and women who live in an humble situation of life, or in an unrefined state of society, are scarcely ever liable to this complaint, because they are free from the restraint of company, and can evacuate the contents of the bladder whenever it is necessary. Those in the highest ranks, not being ashamed to withdraw from company, are nearly in the same situation.

171. But those, who, in a middle state of life, with decent yet not over refined manners, have

not cast off the bashfulness of the former, nor acquired the freedom of the latter, are most subject to the retroversion of the uterus. The great danger in this case arises from not ascertaining the precise character of the disease; although even here, if the bladder be emptied, alarming consequences are not likely to ensue. Our first object then is to evacuate the urine, and the catheter may be slightly curved, the concavity being directed to the sacrum, or we may use a flexible male catheter, although in general the common instrument succeeds. The catheter must be very slowly and delicately introduced, and should not be pushed further into the bladder than is necessary to relieve the distension. We may, perhaps facilitate its passage, where there is difficulty, by introducing the finger into the vagina, and depressing the os uteri, at the same time relieving the bladder from the vaginal tumor. Pressure on the abdomen will enable us more completely to empty the bladder. As soon as we have completed this operation, a clyster or some aperient medicine should be exhibited.

172. Instances are recorded where the retroversion has been immediately removed on the evacuation of the contents of the bladder; but it may continue, and Denman seems to think that, if the symptoms are not urgent, the uterus may remain in a retroverted state for many days or weeks, without any other detriment than what may be occasioned by the temporary interruption of the discharges by stool or urine: and, contrary to all expectation, it has been proved that the uterus, when retroverted, will often be gradually and sometimes suddenly restored to its position, without any assistance, provided the cause be removed by the occasional use of the catheter. It appears that the enlargement of the uterus, from the increase of the ovum, is so far from obstructing the ascent of the fundus that it contributes to promote the effect; the distension of the cervix becoming a balance to counteract the depression of the fundus; for no cases of the retroverted uterus admit of reposition with such difficulty as in women who were not pregnant, in whom the uterus underwent not any or no material change.

173. In the practice to which these statements would give rise we accord to a great extent, but if, in the course of a short time, a reposition of the uterus did not spontaneously occur, we should feel disposed, by manual assistance, to attempt the replacement. Having put the patient in such a position that the hips shall be more elevated than the shoulders, and the thighs brought to right angles with the body, we may pass one or two fingers into the rectum; and then, by the aid of a piece of sponge, fastened to the end of a small bit of cane, according to Dr. Haighton's suggestion, gently pushed up the gut, until it comes in contact with the promontory of the sacrum, we may act on the retroverted womb; and now two fingers may be advantageously introduced into the vagina, so as to depress the cervix uteri, thus influencing the womb from two points. If we fail, after a judicious repetition of these measures, Dr. Hunter advises that the ovum should be tapped, so that, by letting off the water, its bulk should be diminished Even if we succeed the bladder will require sedulous attention; and, at least till quickening is fully established, we must prevent any extensive accumulation of urine in this viscus: of course, when the uterus has fairly emerged from the pelvis into the abdominal cavity, it cannot again be retroverted.

Of Quickening.

174. The quickening of the child, so termed because, at this period, it was erroneously supposed to be endowed with the principle of life, is an important event. The earlier affections of pregnancy, or those which may be supposed more especially to depend on the irritability connected with this state, are now yielding to a new class of affections, which result in a great measure from the increased weight of the womb, and from its consequent pressure on surrounding parts. We must allude, before we proceed further, to the erroneous opinion, so long entertained, and on which the English law is founded, that when the child quickens it first acquires vitality. From the moment of impregnation the fœtus is in possession of this principle; and it is only at this time, from circumstances we are about to explain, that it affords increased manifestations of this power. It is to be expected, when the uterus is confined within the cavity of the pelvis, and when the proportion of the liquor amnii is large compared with the size of the child, that its movements should be indistinct; but when the relative quantity of water is smaller, when the womb has fully emerged from the pelvis cavity, into a situation where it is less restrained, and where the sensibility is perhaps greater, the motion is stronger and more decidedly felt. It is possible for women to be deceived by the intestinal movements of wind, fancying that they are the motions of the child.

175. This deception most frequently occurs where there is a disposition to favor the idea of pregnancy. If this feeling did not exist it would be easy to convince such patients that genuine uterine sensations, produced by a child in the cavity of the womb, can only be felt in certain parts of the abdomen. We are now in attendance on a lady who, from irregularity in the menstrual discharge, supposed herself in a state of pregnancy; she is twenty-six years old, and has been married five years without having been once pregnant. Several of the early signs of pregnancy, as slight nausea, darkening of the ariola, and capricious appetite have existed. The breasts are much enlarged, and the abdominal intumescence is considerable. We have always entertained doubts as to this lady's state; for during the eight months of supposed gestation she has very sparingly menstruated six or seven times. On examining the abdomen we perceived the fundus uteri behind the ossa pubis, and we felt convinced, on further pressure by the hand, that the abdominal enlargement was principally attributable to adeps and air. On examination, per vaginam, the cervix uteri was not at all developed; it was of its original length, and we were able distinctly to ascertain that the uterus was not at all increased in size. We think

these are the cases of supposed pregnancy most commonly occurring; a lady is desirous of having a family, never having perhaps been a mother, or having advanced to that age when it is improbable she shall again bear children. From some accidental circumstance the menses become irregular, or they are suppressed for a few weeks beyond the usual period. Expectations are cherished; rest is enjoined; and capricious appetite, in conjunction with some other of the early signs, leads the patient to believe that she is most probably pregnant. When menstruation again occurs it is thought rather unnatural; but as every effort is employed to diminish its quantity, and to shorten the time of its flow, it may not continue more than a day and a half, or two days. Indolence and indulgence succeed to activity; the same quantity of nutritious food continues to be taken; the bowels become torpid from want of exercise, and from the accumulation of the ingesta. If we add to these circumstances the secretion of air in the intestinal canal, the deposition of adipose matter in the abdominal integuments, and the fatty enlargement of the mammæ, we have no difficulty in comprehending how patients may deceive, not only themselves, but, by strong statements of their symptoms, even their medical attendants.

176. We could enumerate several such cases as these, and one in particular, where the abdomen was never exceeded in size, in the ninth month of pregnancy, except perhaps in the case of twins; and where there was every concurrent indication, excepting the suppression of the menstrual secretion. It is needless to add, that even here there was no pregnancy. We wish to observe that the practitioner ought never absolutely to commit himself, as to the existence of pregnancy, without an examination of the uterus itself; and, as much as possible to simplify and illustrate this important and practical part of our subject, we shall recapitulate a few particulars. The fundus uteri, when it ascends from the cavity of the pelvis, is situated forwards, and its mouth and cervix posteriorly; it is manifest, therefore, that the intestines cannot lie before it (an important circumstance in external enquiry); but they must be situated posteriorly and at its sides.

177. The fundus again, previously to its ascent, and in proportion to its increasing development, will afford a large surface for the pressure of the superincumbent intestines; and the mouth and cervix uteri, will necessarily be forced lower down in the vagina. The mouth of the uterus is always sufficiently open, in the unimpregnated state, to admit easily the tip of the finger. Soon after conception it is closed, and is only to be penetrated, if gentle efforts are employed first within its edge. As pregnancy advances it becomes gradually softer, although it is not till the fifth month that the cervix is decidedly developing itself. In the seventh month this process is so far advanced that we may, by a well conducted examination, feel the head of the child; in the eighth month the neck is completely destroyed for the purpose of enlarging the uterine cavity; and it is situated as high as the brim of the pelvis.

178. These facts should always be impressed on the mind, whenever we make an examination; and if we conduct it slowly, remembering that the indications furnished by disease resemble to some extent those of the gravid state, we shall not be liable to error. If we examine in the second month, which is seldom required, and still more rarely necessary, we shall perceive the gravitation of the uterus downwards, and the cervix will be closed. When elevated by the finger it will to an experienced examiner feel heavier, and rather more resisting than in the unimpregnated state. We should not, however, express a decided opinion from the indications of this early period. In the third and fourth months, we may arrive at greater certainty, from the increased size and weight of the womb. During the fifth month an examination may be conducted with confidence, the uterus having risen above the brim, and by pressing its fundus we may impart to the fingers in the vagina a distinct sensation of resistance and rolling. Under these circumstances we can at any rate pronounce the womb to be enlarged; and, if we hesitate as to the precise nature of its contents, we have at least obtained some positive information. After this period the alterations of the cervix, the increasing development of the uterus, and the movements of the child, will generally conduct us to a certain and well grounded opinion. If there be any doubt, after examining by the vagina alone, we advise the practitioner to introduce one or two fingers into the rectum, thus placing the uterus between the action of both hands, in which case he can scarcely fail to ascertain with precision the extent of the enlargement. He may also introduce a catheter into the bladder, and, by gently moving about its rounded extremity in the cavity of this viscus, he may press the uterus backward against his fingers in the rectum, and thus acquire additional information as to its size and condition.

179. We shall now treat of the class of complaints incident to the *advanced stages* of utero-gestation, of which it is scarcely necessary to observe that they are more painful and dangerous than those we have already enumerated. For, while the death and premature expulsion of the fœtus is the worst result of the one, the safety of the mother, as well as the destruction of the child may be involved in the other.

180. Nausea and vomiting may still continue to render it necessary to maintain an almost entirely empty state of stomach, nourishment being acquired by clysters of beef-tea and jelly. The occasional exhibition of solid opium will prove highly advantageous, notwithstanding which the vomiting may go on to harass and debilitate the patient, and may reduce her to a state of extreme danger. In these circumstances it is very justifiable to induce premature labor; and we regret that an attempt of the kind was not made in the subjoined case. Dr. Marshall Hall mentioned to us the case of a lady, in whom vomiting continued in spite of every remedy which a most experienced practitioner could suggest, and induced a fatal termination in the seventh month.

181. Jaundice sometimes occurs in the latter stage of utero-gestation, more as the consequence

of the state than from any schirrosity of the liver or disease of the biliary ducts. The treatment is generally confined to palliatives, although there is perhaps no sufficient reason why pregnant women should not bear the operation of the proper remedies for its cure. For ourselves we should especially recommend an early regard to affections of the liver during pregnancy, if they be conjoined with inflammation. A lady, the wife of a very able practitioner in the country, was attacked with symptoms of jaundice in the latter months; they were not disregarded, but inflammation of the liver succeeded, and in spite of the most vigorous treatment it terminated fatally in a few days.

182. *Costiveness* is often a very troublesome attendant of the later periods of gestation, arising from the pressure of the enlarged uterus on the rectum. We do not advocate the continued exhibition of purgatives, much less those of an aloetic or drastic kind; still, as torpor of the bowels is naturally incident to pregnancy, we are always desirous of preventing any such accumulation of feculent matter as may give rise to what has been vulgarly denominated the 'ball stool.' Not to dwell on the distressing sensations produced by excessive and almost continual constipation previously to labor, we have known during the act of parturition itself very serious delay arising from this cause, and more than once we have been compelled to empty the rectum before the head could be propelled into the world. Denman says 'that he was at one time very assiduous in preventing costiveness; but that afterwards he became much less so, observing that all women who went on properly, especially in the early part of pregnancy, were liable to this state of the bowels, which may have some relation to the strong action of the uterus at that time. Costiveness may, therefore, be considered as a state of the bowels corresponding with that of the uterus; and we never can believe that to be injurious which occurs so frequently as to be esteemed a common consequence.' We may further observe, in corroboration of this statement of Dr. Denman's, that not only is abortion most frequent in those patients who are habitually prone to too relaxed a state of the bowels, but that it is frequently produced by the relaxation which succeeds the exhibition of aperients or purgatives.

183. Women during pregnancy must resort to opening medicine, and we should enjoin the use of that which is most simple and mild. A teaspoonful of castor oil taken three or four times a week on going to bed, aided on the following morning by the injection of a pint of warm water into the rectum, will frequently preserve a comfortable aperient state of the bowels throughout the whole period of gestation. Magnesia in small doses, perseveringly taken, is sometimes productive of equal benefit; although from its chemical properties it is often uncertain, and sometimes violent in its operations.

184. *Hæmorrhoids* are occasionally requiring treatment, and gentle aperients or some of the preparations of sulphur are productive of good. If they are very numerous and much tumefied, leeches may be employed; but pressure on each individual pile, till its cavity be emptied of the blood it contains, will impart much relief.

185. *Affections of the brain*, of the slighter kind, are not very unusual in utero-gestation, and from whatever cause they may arise, whether from a fulness in the vessels of the brain, induced by compression of the vessels of the lower parts of the body, or from an unusual degree of the irritation which to a greater or less extent almost invariably characterises pregnancy, they demand the most careful, and, in some instances, the most prompt treatment. We cannot divest ourselves of anxiety, lest vertigo and head-ache in the latter months should precede convulsions, immediately before or during labor: nor can we expect a complete removal of their effects, if they have been severe, till after parturition. We were a few months since called to a patient in the fifth month, who had suddenly lost the power of distinct articulation, and the perfect command of the left side of the body. The abstraction of sixteen ounces of blood slightly restored her speech, but it was not until blisters, leeches, cupping, and purgatives had been employed, that she spoke at all distinctly. This lady was confined prematurely, without any disposition to convulsion, and the child was born alive. Two months elapsed after delivery before she fully regained her usual articulation.

186. *Syphilis* is occasionally complicated with pregnancy, and there is no doubt of the perfect safety of submitting a patient, under such circumstances, to a judicious and mild mercurial course. By this treatment the mother will be cured, but we are not always so successful with the child; for, although it may be born free from any appearance of disease, yet in the course of a few weeks symptoms of syphilis are not unfrequently occurring. In a lady we lately treated for this disease, and who became pregnant during its continuance, the child was born with copper-colored spots all over its body, although the mother had been perfectly cured for at least five months previously to delivery. This infant was subsequently affected by thrush, and ulcers soon appeared on the arms and labia pudendi. At this time we were not in attendance, but we were informed by the gentleman who had charge of the case that these sores resisted all the simple methods of treatment, and did not heal, till a mercurial plan was pursued. Mr. Hey, whose reputation has scarcely been excelled by any surgeon in this country, states 'that syphilis in its secondary form may be communicated by the mother to the fœtus in utero.' 'That the fœtus may be contaminated when the mother has never been previously affected with lues venerea in the organs of generation, and when no apparent disease existed in the father at the time of impregnation.' 'That the mother remaining in health shall produce several children each of which shall in succession become affected with syphilis a few weeks after its birth and that the disease shall assume a milder form, in each child comparatively, until it be finally worn out.' Mr. Hey confirms these separate statements by a reference to clearly defined cases, in the treatment of which he completely succeeded by the mercurial plan

187. When dropsy or a true ascites is connected with pregnancy, the treatment will require very serious consideration. If the degree of the abdominal distension is not incompatible with delivery, we shall remain satisfied to palliate the symptoms, and as much as possible to restrain the increase of the fluid. This procedure is of course to be pursued independently of any consequences occurring after delivery, these remaining to be treated according to the circumstances which may then arise. If, however, the distension occasions great pain, and endangers the life of the woman, we cannot then wait for natural delivery, we must either bring on premature labor, or the operation of tapping must be performed. Dr. Denman's views on this subject display a timidity not in accordance with the general tenor of his opinions: he says, 'if any active remedies are used for the cure of the dropsy, the child will of necessity be often destroyed, and an abortion or premature labor occasioned; and, when the operation of paracentesis has been performed, it has been known to prove fatal to mother and child, always reflecting great discredit, both upon the operator and the profession.'

188. It therefore seems necessary to establish this general rule, that no woman at a time of life, or under any circumstances which in the most distant manner subject her to a suspicion of pregnancy, should ever be tapped or otherwise treated for dropsy, till by examination per vaginam, or by waiting a due time, we are convinced she is not pregnant, even though she may have before undergone the operation.

189. Burns says, 'when dropsy is arising from the ordinary causes, or from disease of the liver, medicine has seldom much effect in palliating or removing the disease, and the woman usually dies within a week or two after delivery, whether the labor has been premature or delayed till the full time.' Burns is of opinion that if the distension be very great, especially at an early stage, a great part of the fluid may be safely drawn off after quickening, if during the operation, and afterwards, the abdomen be carefully and uniformly supported by a bandage. He thinks the operation is more likely to be succeeded by labor, if performed in the last month, than earlier. A case of ascites, connected with utero-gestation, most ably treated by Mr. Langstaff, is recorded in the twelfth volume of the Medico Chirurgical Transactions. In this case Drs. Farre and Davis, having seriously considered the important nature of the disease, were of opinion that the bringing on of premature labor was preferable to drawing off the water. The unwieldly state of the abdomen, the inability to recline in the horizontal posture, and the immense size of the legs and thighs, rendered the patient indescribably miserable. The liquor amnii, in accordance with these opinions, was discharged; but on the following day as there were no signs of labor commencing, and as dissolution appeared rapidly approaching, Mr. Langstaff cut down to the peritonæum, about two inches below the umbilicus, carefully perforating that membrane, with a moderate sized instrument such as is commonly employed in performing the operation paracentesis abdominis. The fluid, which flowed very freely, was transparent, and, when about ten pints of it had passed off, a moderately large, smooth, and soft elastic gum catheter was introduced through the opening, which, passing downwards for several inches between the anterior part of the peritonæum and uterus, drew off the remainder of the fluid, amounting in the whole to twenty-five pints. Three days after this operation labor occurred, attended by no remarkable circumstance, excepting the detention of the placenta. In the interval between the tapping and the delivery it was found necessary to abstract fifty ounces of blood twenty ounces being taken at one time, and thirty afterwards. In nineteen days after the labor this lady was considered out of danger, and without any dread of re-accumulation of fluid in the peritonæal sac. In conclusion Mr. Langstaff remarks that, from the favorable result of this and Scarpa's case (page 249 of the Quarterly Journal of Foreign Medicine and Surgery), he should be induced to recommend tapping before the hydropic symptoms became so distressing; and from what he has seen of dropsy, occasioned by plethora, or an inflammatory state of the arteries, he should expect that the further effusion of fluid into the peritonæal sac, during pregnancy, might, if detected before the accumulation was considerable, be prevented by blood-letting, and ultimately the absorbents might be induced by proper treatment to carry off the fluid. But this fortunate termination could only be expected where effusion was merely the result of simple inflammatory action, unconnected with visceral disease.

PART III.

LABOR IN ALL ITS VARIETIES.

190. Having now completed the preliminary divisions of our subject, and trusting that although concisely they have been clearly and comprehensively treated, we shall at once proceed to the practical part of the science, by which the truth and value of all its principles must ultimately be tried. If hitherto we have endeavoured to select, from the general store of obstetric knowledge, what appeared necessary to be fully known; so in this part, by far the most important and responsible in midwifery, we shall aim to present the rules of the art in as simple and efficient a form as possible. Here we discover the improvement of midwifery, and we shall feel surprised, if we retrace its progress for the last 150 years, at the perfection it has attained. We think there are few if any cases, excepting anomalous ones, which a practitioner may not be prepared to encounter; and if, with the information to be thus attained, he combines judicious promptitude, tact, and delicacy, there is no difficulty in believing that he may practise midwifery with comfort and success. Let it however be remembered, that if, in the case of an important artery being wounded, it may be necessary for the surgeon instantly to exercise his anatomical knowledge and surgical skill; so in sudden hæmorrhage, occurring in parturition, if the man-

ner of procedure have not been previously arranged the patient may die in the few minutes required for deliberation. The term of utero-gestation in the human species has been much controverted; a variety of causes has contributed to this difference of opinion; females on such subjects do not give correct and precise information; practitioners commence their calculations at different periods, some immediately before, others directly after, the last appearance of catamenia, while it is by far the most common to commence the reckoning from a fortnight subsequent to the last menstruation. We believe that few cases of pregnancy will be found to exceed forty clear weeks from the time of conception; although we are not disposed to acquiesce in the opinion recently delivered in the house of lords, that the term of pregnancy cannot exceed 280 days, or ten lunar months. We find in other points relative to conception, gestation, and parturition, an almost infinite variety; nor can we yet discover any facts irrefragably proving that the general term of human pregnancy cannot be exceeded. We are fully aware that this question will not admit of arguments from analogy, or these would favor the opinion to which we incline. We trust that future and more correct observation will determine this litigated point, not merely for the purpose of demonstrating who are right, but that in cases where it is necessary to induce premature labor, we may do it with the utmost probability of preserving the life of the child. A few years since we attended a lady who gave us the following particulars, and on their accuracy we can rely. She ceased to be regular on the 25th of January; a few days afterwards her husband set out on a journey, and remained absent about six weeks; there was no return of the catamenial discharge, and she was not confined till November the 27th of the same year, a period probably of 304, but at all events of 300 days, from the last menstruation. This lady was unusually large, and her child much finer than any she had previously borne. Hippocrates extends the term of utero-gestation to ten months; and the Roman law, founded probably on the opinion of Hippocrates, allows ten months to ensue between the death of the husband and the legitimate birth of the offspring. France, we believe, has adopted this term; and Haller has furnished examples of pregnancy extending to eleven and even twelve months. Our own law has not prescribed any imperative rule on this subject, preferring rather to be guided in its decisions by facts, which, in the opinion of those most capable of estimating their value, may influence individual cases.

191. Dr. Merriman, the author of a valuable work on difficult parturition, has bestowed considerable attention on this subject. He informs us, 'that he is very exact in ascertaining the last day on which any appearance of catamenia was distinguishable, and has reckoned forty weeks from this day, assuming that the 280th was to be considered as the legitimate day of parturition. Of the births of 114 mature children, calculated from, but not including the day on which the catamenia were last distinguishable,

3 occurred	in the	37th week.
13	. .	38th.
14	. .	39th.
33	. .	40th.
22	. .	41st.
15	. .	42nd.
10	. .	43rd.
4	. .	44th.'

The position of the child in utero has been variously described; it used formerly to be thought that it sat or rested with the breech on the brim of the pelvis, the foreparts of the child being turned towards the abdomen of the mother. Before the different stages of labor were correctly understood and described it was believed that at the time of parturition, principally by its own weight, the head descended into the cavity of the pelvis, in such a direction that its vertex was turned towards the ossa pubis, and its face into the hollow of the sacrum.

192. Harvey has investigated the position of the fœtus in utero with great care, and we shall present his account to our readers, premising that the arrangement of its parts is such as to occupy the least possible space, affording the utmost facility to its own movements, and as little inconvenience as possible to its parent. We may also remark that it is highly probable its situation remains the same during the whole term of gestation, so that, if the head lie over the centre of the pelvis in the commencement, it will generally be so situated at the termination of pregnancy, unless there have been any violent actions or movements on the part of the mother.

193. The general position is as follows:—the knees are drawn up to the belly, the legs are reflected backwards, the feet crossed, and lying close to the breech; the elbows are in contact with its sides, and the hands turned up to its head, one of which is often placed upon the cheek or ear. The spine is incurvated, and, the neck being bowed, the chin rests upon its knees. There is that inflexion of the body into which we spontaneously fall, when we seek repose; and, as it is our position before we are born, it is that also to which we have an inclination in the decrepitude of old age. Adductis ad abdomen genibus, flexis retrorsum cruribus, pedibus decussatis, manibusque sursum ad caput sublatis, quarum alteram, circa tempora vel auriculas, alteram ad genam detinet, spina in orbem flectitur, caput ad genua incurvato collo propendet; tali membrorum situ, qualem in somno quietem quærimus.—Harv. Exercitat de partu. The bulk of the body of the child is not placed against the spine, but on one side, most commonly on the right, and the limbs are turned towards the left, so that the abdomen of a woman with child is in general evidently distended more on one side than the other. No suspicion need in consequence be entertained that the presentation at the time of birth will be unnatural.

194. Before we commence the history of labors, in order to simplify and facilitate the comprehension of them, they may be divided into classes and orders, bringing together those which agree in some essential particulars, and

which require nearly the same treatment. By this method we shall be able to convey the practical precepts of the art with perspicuity and force. The term labor is not solely applicable to human parturition, as it may express any act performed with difficulty and pain; we cannot, however, controvert the peculiar propriety of its employment to characterise the whole of this momentous process, the circumstances of which it is well suited to describe.

195. We shall divide labors into three classes:

I. Natural.

II. Difficult.

III. Complex, or anomalous.

Class I. *Natural labor* may be defined that which is occurring at the full time, the head of the child presenting, and the process being completed within twenty-four, or twelve, or frequently within six hours, without artificial aid, or the occurrence of any morbid affection. This comprises three orders.

Order 1. Quick labor, in which the process is easily completed within the prescribed time.

Order 2. Lingering labor, the head of the child still presenting, but continuing beyond twenty-four hours, instrumental aid not being required.

Order 3. Twin labor.

Class II. *Difficult labors*, or those in which the child may or may not present the head, and where the natural powers are generally insufficient to accomplish the delivery. This comprises three orders.

Order 1. Presentations of the breech, of the superior or inferior extremities, or any combinations of these presentations, and which require manual aid.

Order 2. Labors which cannot be completed without the aid of extracting instruments, of which some are designed to save the lives both of the mother and the child; while others are intended to preserve the life of the mother, at the expense of the life of the child.

Order 3. Impracticable labor, or that in which the child, even when as much as possible reduced in size, cannot pass through the pelvis, and where the Cæsarean operation becomes necessary.

Class III. *Labors of a complex or anomalous character*, comprising three orders.

Order 1. Labor complicated with uterine hæmorrhage, including those labors where the placenta fully or only partially presents.

Order 2. Labor complicated with convulsions and syncope.

Order 3. Labor complicated with rupture of the uterus, suppression of urine, or rupture of the bladder.

196. It is very important to obtain clear and precise ideas of the progress and circumstances of natural labor; for if we have a standard pelvis and a standard head, of which all other pelves and crania may be considered only as varieties; so natural labor may form a standard, to which all others, in a greater or less degree, must approximate, their safety or danger being correctly estimated by their likeness or dissimilarity to natural parturition.

197. Thus, if any of the marks in the definition of natural labor be wanting, it must come under some other class. If, for instance, the head is not the presenting part, it must be placed in the class of difficult labors; and, if manual aid be required, it will form part of the first order of this class. Again, if the head should present, and convulsions should occur, it will not be a natural labor, but must be considered as belonging to the class of complex parturition. A natural labor, says Denman, was the last thing well understood in the practice of midwifery; because scientific men, not being formerly employed in the management of common labors, had no opportunity of making observations upon them. Practitioners were then engaged in qualifying themselves for the manual exercise of their art, whenever they might be called on to give assistance; and not in making nice distinctions, or investigating the particular cases in which only it might be necessary to exercise it.

198. Dr. Smellie supposes that, out of 1000 women in labor, eight shall be found to require instruments, or to have the child turned in order to avoid them; two children shall present the superior extremities; five the breech; two or three the face; one or two the ear; and ten shall present with the forehead turned to the acetabulum.

199. Dr. Bland says that, out of 1897 women, 1792 had natural labor. Sixty-three, or one out of thirty, had unnatural labor; in eighteen of these the child presented the feet; in thirty-six the breech; in eight the arm; and in one the funis. Seventeen, or one out of 111, had laborious labor; in eight of these the head of the child required to be lessened; in four the forceps was employed; and in the other five the face was directed toward the pubes. Nine, or one in 210, had uterine hæmorrhage before or during labor. It is evident that this register cannot form a ground for general calculation; and we perceive that the number of crotchet cases exceeds those requiring the forceps, which is not observed in the usual cases of practice.

200. We cannot form any correct opinion from the practice of individuals, as some may, from peculiar circumstances, encounter more of difficult midwifery than is fairly proportioned to the number of their patients. Thus Dr. Hagen of Berlin says that, out of 350 patients, he employed the forceps ninety-three times, and the crotchet in twenty-eight cases; twenty of his patients died. Dr. Dewees, of Philadelphia, says that in more than 3000 cases he has not met with one requiring the use of the crotchet.

201. *On the changes immediately previous to parturition.*—At the expiration of forty weeks changes occur, which intimate pretty clearly that some important process is about to be commenced, and these changes have been denominated the predisposing signs of labor. There is at this period a partial subsidence of the abdominal enlargement; and many women are able correctly to foretell, from this circumstance alone, the early occurrence of labor. Whenever the fundus of the uterus is thus descending, it indicates a favorable disposition to parturient action: for, it is well known, if, after the commencement of labor, the patient complains that the child is

very high, it is unfavorable, proving that the fundus is either inactive, or disposed to act irregularly.

202. The follicular apparatus about the neck of the womb is now pouring out a glairy and viscid secretion; which, when it immediately precedes labor, and from the rupture of some small vessels, is of a sanguineous color, we denominate show.

203. Some women, from their manner of walking at this period, and from the statement of their feelings about the pelvis, would induce the belief that there was some relaxation of ligaments, and that the popular expression of falling in pieces is not altogether unjustifiable. These changes are often accompanied by irritation of the bladder, and by griping tenesmic sensations in the intestines and rectum. These are the principal circumstances inducing the belief that the expulsatory action of the uterus is about to commence; and, in the language of old Avicenna, that the 'appointed time having arrived, labor comes on by the command of God.'

204. *Delivery*.—It is scarcely necessary to remark that in the term delivery we include the complete expulsion of the fœtus and the secundines; but as there are certain parts of the process which are distinct, and as protracted intervals may occur between them, we shall consider parturition as divided into three stages; the first stage terminating with the complete expansion or dilatation of the os uteri, the rupture of the membranes, and the discharge of the waters; the second stage including the complete expulsion of the child; and the third, which we regard as the most important, terminating with the detachment and expulsion of the secundines. In the first stage of this process our interference is not very frequently necessary; in the second we may have to put in practice the difficult, yet almost certainly efficient, rules of the art; but in the last stage of parturition, when danger from flooding arises, the life of the mother will almost entirely depend on the knowledge and promptitude of the medical attendant. It is a rule in midwifery to see a patient about to be confined as early as possible; for there may be a preternatural presentation; and from the rupture of the membranes, and the escape of the water, the favorable moment for turning may be lost previously to the arrival of the accoucheur. Flooding may endanger the life of the patient; and, in presentations of the feet, the expulsion of the child may have been so far accomplished, as that its head and body, being retained within the uterus, pressure on the umbilical cord may destroy the life of the child, when prompt obstetric aid might have preserved it. We should advise every accoucheur to carry about him the tincture of opium, a catheter, a tracheal pipe, and of course a lancet. It is scarcely necessary to illustrate this advice, by pointing out the various circumstances in which their employment may be required. Opium is invaluable in allaying the irritability produced by false or spasmodic pains; and every one is aware of the relief it affords in those necessary contractions of the womb occurring after almost every labor, with the exception of the first.

205. No one would employ obstetric instruments without previously ascertaining the state of the bladder, and this viscus is generally loaded with urine in difficult parturition. Where the os uteri is rigid, and the patient robust and plethoric, the abstraction of sixteen ounces of blood, at the commencement of labor, is frequently attended with marked benefit. The tracheal pipe is of great value in resuscitating the child, all other means being decidedly less efficient for this important purpose.

206. We have already alluded to certain changes indicative of approaching parturition; on these presumptive signs, however, we cannot give an opinion that the process has commenced; to do this with certainty we must examine per vaginam, which at the time of labor is denominated 'taking or trying a pain.' Women will scarcely ever allow this examination till they are convinced that labor has actually commenced, and then they are solicitous to be informed of its progress, and the probable period of its termination. The position in which this enquiry, and indeed the delivery, is to be conducted, varies amongst different nations, and in different districts of the same country. The German ladies are delivered while sitting, so that the full effect of the pains is exerted on the child's head over the centre of the os uteri. In Ireland they are frequently placed on the knees and elbows. But, in our own country, women generally repose on the bed upon their left side, with their knees bent, and drawn towards the abdomen; and this is sufficiently convenient for all common purposes.

207. This examination is to be conducted with the utmost delicacy and tenderness, as an unfavorable opinion of the accoucheur's skill and kindness may retard the progress of the labor. It may be needful to ascertain, per vaginam, even when labor is thought to have commenced, whether there be any disease of the uterus or of the parts in its immediate neighbourhood, whether a woman be really pregnant, to determine whether she be really in labor, what progress has been made, the character of the presentation, and whether the pelvis be well formed or distorted.

208. The author of this paper was once sent for to a case where the accoucheur had been up two nights expecting the birth of the child, and, on examination per vaginam, the uterus was found in its unimpregnated condition, the abdominal intumescence having arisen partly from adeps and partly from air. Dr. Blundell relates a case of this kind attended by a most unfortunate result, which we shall present in his own words:—'A gentleman called at my house and told me, not without earnestness, that he had under his care a case of labor about which he was very anxious. 'The mouth of the womb,' said he, 'is beginning to open, and I can feel the child; but the patient is somewhat weak, and labor makes but little progress.' On enquiring how long delivery had been protracted, a few hours was the reply, and he added that there was no very pressing symptom.

209. 'A meddlesome midwifery is bad' I rejoined; 'therefore it is better to wait, and not

unwisely and rashly distrust the best of accoucheurs, Nature, the mother of us all.' A day or two passed away, after which he called on me again, observing that his patient, still undelivered, was getting weaker and weaker, and that he wished me to give her a visit. On entering the appartment I saw the woman lying in state, with nurses, accoucheur, and all the formalities attending a delivery; one small point only wanting to complete the labor, which was, that she should be pregnant; for, although the practitioner had distinguished the head of the child in the uterus, there was in reality no fœtus there. A few hours afterwards the patient died; and, on examining the abdomen, we found the peritonæum full of water, but the womb, clearly unimpregnated, was no bigger than a pear; and thus it sometimes happens that we are called to reputed deliveries when, in truth, the patients are not even pregnant; and it is, therefore, one office, which, in natural labor, devolves on the the accoucheur to decide, in dubious cases, whether pregnancy exist or not.

210. The first stage of labor is generally the most tedious: it is attended by frequent, short pains, which are generally characterised as cutting and grinding. There is seldom much difficulty, when these have existed some little time (and we are not often called in before), to determine whether labor has really commenced; the greater difficulty is, to give a correct opinion as to the time which may be required for its completion. For this latter purpose great judgment and experience are required, and, even when these are fully possessed, it will be better, while we are careful not to discourage the patient, to lean to the side of doubt rather than of confidence. We may observe here, without attempting any explanation of the facts, that labors do really seem to proceed in regular periods of time, so that a labor which commenced at twelve o'clock at night, if not terminating at noon the next day, will frequently continue till twelve o'clock the next night. The remark is almost proverbial that uterine operation is suspended through the day, more especially in summer, to be again resumed during the night.

211. If it be really important to say precisely whether labor has begun, and to afford encouragement as to its progress, we must not form our opinion from the mere openness or relaxation of the os uteri during the absence of pain, but from the degree of dilatation which the accession and continuance of pain really produces. In cases where labor has been suspected, and where we have been allowed to examine, we have frequently found a considerable degree of relaxation, even where labor did not occur for some days or even weeks afterwards. Supposing the pains to continue, we may easily ascertain the extent to which the os uteri is affected; for if, from a degree of dilatation scarcely sufficient to admit the tip of the finger, the pain induces such uterine contraction as shall enlarge its disc to the size of a shilling, and by a few succeeding efforts to that of a dollar, we can entertain no doubt that the labor is really begun. If additional certainty be desired, the state of the membranes, during pain, will afford some criterion. If, from being flaccid, they become tense, and are protruded downwards, we may feel certain of the commencement of labor. If the membranes are ruptured, the same observations may be made on the head, which will advance and retreat during the pressure and inactivity of the uterine effort.

212. It is worth while to remark that women, especially if they have once gone through a difficult labor, will anxiously enquire 'if it be all right,' in other words, if the head is the presenting part; now, although this knowledge cannot always be obtained in so early a stage as that we are now describing, we may sometimes succeed in passing one or two fingers into the mouth of the womb, and, through the membranes, distinguish the presenting part. If we fail in this we may insinuate the fingers between the os uteri and the symphysis pubis, and if the vertex be presenting we shall easily feel it behind and above the ossa pubis.

213. A diversity of practice has obtained in the management of the membranes; some practitioners invariably leaving their rupture to the natural efforts, while others as invariably break them by artificial means so soon as they are within reach, and before the dilatation of the os uteri is accomplished. Of the latter practice we do not approve; the rule should be to leave their rupture to the natural efforts; the exception to produce it by artificial means. There are two instances in which the rupture of the cyst is fully justifiable; first, when, at the sixth or seventh month, there is an attempt to throw off the ovum entire and unbroken, in which case there may be most alarming hæmorrhage from the placental vessels, and the fœtus may probably be drowned in its own waters. And again, when the membranes are unusually tough and unyielding. Here we have known labor delayed several hours from an unwillingness to interfere with its natural progress. If, however, we find the membranes pushed down along the vagina, and protruding beyond the vulva, we may feel assured the os uteri is fully expanded; and we cannot err if, during the height of a pain, we force a stilette through the cyst, after which the child will sometimes be immediately expelled. Supposing the membranes to have been ruptured, and the liquor amnii to have escaped, the first stage of parturition is completed, and the very important duty of ascertaining the presentation devolves upon the accoucheur. It may be true in labors generally, and the remark is not rare in relation to the whole of obstetric practice, that it is of very little importance whether we know the presentation or not, as it is most commonly a natural one, and the child will be safely born independently of our assistance. But this does not always happen; the child may lie unfavorably; the aid of a skilful practitioner may be required, and complete success will very much depend on the bestowment of that aid before the uterus has fairly contracted itself round the body of the child. We cannot, therefore, be too particular in promptly ascertaining the presentation. When the head has passed through the os uteri, and the pains continue forcing and powerful, we must carefully watch its progress, lest, by the

suddenness of its protusion, the perinæum may be lacerated.

214. In first labors, and where there is a rigid unyielding condition of the softer parts, the protection of the perinæum is of great moment. It is not perhaps possible, and if it were so, it is not desirable, forcibly to prevent the descent and expulsion of the head; as rupture of the uterus may occur if the birth be too long delayed. To protect the perinæum we always employ the right hand, without the interposition of any napkin; kneeling by the side of the bed, the patient being in the usual position, we apply the naked hand over the perinæum, the fingers, supposing it to be a vertex presentation, reaching as far forward as the occiput. If the pains are not very vehement we merely request the patient not to force down during their continuance; if, however, there is a great degree of tension, laceration of the perinæum may occur, and then we resist the violent propulsion of the head, as much as we dare, by forcible pressure on all the parts of it within our influence. Lard and pomatum may be largely employed, as they not only lubricate the parts, but diminish the sensations of heat. The child generally comes into the world with the occiput forwards and the face posteriorly; and, when it has fully emerged, there is no necessity to hasten, by any efforts of ours, the expulsion of the shoulders. We ought ever to bear in mind that the less we interfere in natural labor the better. The ordinary efforts, in eight cases out of ten, will expel the shoulders, and the uterus will contract itself more regularly and effectively, and the placenta will be much more safely and quickly detached, where no attempts at extraction have been made. In the little interval which thus occurs we may examine whether the navel-string be round the neck of the child; and, where it is so, we may generally succeed in disentangling it, by gently drawing down another portion of it, and then passing it over the chin and face, thus setting it at liberty. If, as in an instance which lately occurred to us, the cord be coiled round the neck five or six times, although the birth may be a little delayed, we had better defer any attempt to disentangle it till the child is born, when it may be untwisted with the utmost facility.

215. In bringing away the child its abdomen should be kept, as nearly as possible, to the external generative organs of the mother. The reasons for this procedure are obvious. The cord, although usually two feet in length, may be preternaturally short; and, were the child to be suddenly removed to some distance from the mother, the womb might be inverted or the placenta partially detached. Both these events are obviated by an observance of the above rule. When the child has cried the first thing to be done is to tie the cord. This may be accomplished by a broad ligature, composed of coarse thread, or silk, several times doubled; for if the 'navel-strings,' as they are termed, be made up of only a few threads, they may cut the cord, giving rise to a fatal hæmorrhage. It is usual to apply the first ligature at a distance of three or four fingers' breadth from the navel; first making a single knot, and, having passed it round the cord in the same crease twice more, we may conclude by a double knot, firmly and tightly made. The second ligature is one of minor importance, and on the continent is seldom used; it may be applied at two or three inches, distance from the former, nearer to the placenta, and a single knot will suffice. In afterwards dividing the cord, by a pair of scissors, between the two ligatures, we must be careful not to cut it too near the first, as the ligature may afterwards slip, and endanger the life of the child. We wish to observe that when the child has cried vigorously, and moves about powerfully, we need not hesitate immediately to apply the ligature; if, on the contrary, its breathing is imperfect, and scarcely perceptible, from whatever cause it may proceed, we should defer the application of the ligature, and afford it the advantage of the placental circulation, till, by the warm bath and artificial respiration, we have fully established its independent vitality.

216. Before we attempt the delivery of the placenta, which constitutes the principal duty of the third and last stage of labor, we should ascertain whether there are any more children. This may be done by laying the hand upon the belly, and gently grasping its contents; if there be no other child, we shall find the abdominal parietes soft and flaccid, while the uterus, now become a circumscribed hard body, like a child's head, will be felt in the centre. Under this state of the uterus we need not hesitate to deliver the placenta, more especially as it will generally be found lying in the vagina. We may lay hold of the funis by the left hand, and passing up one or two fingers of the right, to the insertion of the cord, we may gently draw down, and we shall soon find the placenta passing through the os externum. Some practitioners are very particular in their directions about the membranes, and for ourselves we invariably attempt, by a very gentle withdrawal of the placenta, to insure the complete extraction of the secundines; thus obviating the painful contractile efforts which are subsequently made to expel them from the uterine cavity, and at the same time removing a source of annoyance, in the offensive smell to which, by their putridity, they may give rise. The bandage contrived by Mr. Gaitskell of Rotherhithe, which we have used, or a long towel, may be applied round the abdomen so firmly as to give a feeling of support, and, if there be any faintness or exhaustion, a few spoonfuls of brandy and water, flavored with spice, may be given. These, then, are the principal circumstances occurring in natural delivery, which, as it serves for the standard of all others, we shall briefly recapitulate. Let it be remembered that we have rarely to determine whether the woman be in a state of pregnancy, and that, from the existence of the grinding and sawing pains, we are still more rarely called upon to ascertain whether labor has or has not commenced. The rule is, not to rupture the membranes; the exceptions arising from their unusual toughness, or from a disposition prematurely to throw off the whole ovum. In every labor the presentation is to be made out as early as possible: if not previously at least

when the waters have passed off. In the first stage of labor little interference is necessary; but, when the head approaches the outlet, the perinæum should be carefully guarded. When the head has emerged, ascertain whether the cord be coiled round the child's neck, and, if it can be easily effected, disentangle it. The shoulders are not to be extracted by force, as the womb contracts more perfectly when allowed to expel the child by its natural efforts.

217. The fœtus is to be kept near the genitals of the mother till the cord is divided; and when this division of the funis has occurred ascertain that the ligature appertaining to the child is secure; and lastly, by care, and the application of the abdominal bandage, guard against uterine hæmorrhage.

218. *Observations on natural labor.*—We believe, in a state of nature, there is very little solicitude entertained, and very little preparation made for delivery. We find, from the accounts of various authors, that a seclusion of a few hours in some retired spot, or in a rudely constructed hut, is all which women living in a state of natural simplicity require for the completion of their labors; and after some slight ablutions, if religious custom does not demand their separation, they almost immediately return to their usual mode of life.

In countries where a high degree of civilisation prevails, and especially in Europe, parturition excites much attention, and is conducted with great care. Some patients prefer being delivered on a couch or bed distinct from that on which they are afterwards to sleep, a manifestly undesirable arrangement, as their removal after labor, especially if it has been severe, may be attended with syncope and alarming hæmorrhage. The bed is to be guarded; and this will be best effected by laying a large skin of red leather on that part of it where the hips are placed, and over this one or two blankets, or two or three sheets, so folded as to form a mass, which may absorb any fluid discharged during the labor; over these spread out another sheet, which, if fastened to the bed-posts, will keep the whole apparatus in its proper place.

219. The guarding of the bed is the office of the nurse, and with it the accoucheur has little concern; but it is necessary to touch on this familiar topic as, when the accoucheur is of puerile appearance, nurses will sometimes enquire, ex insidiis, in what manner he wishes the bed to be guarded. Now if he were at a loss here: if he were ignorant of the apparatus; if, surprised, he were to ask what the woman meant, adding perhaps surlily that the only guard necessary was himself, she would infer that he had seldom been at the bedside before, and presume that he was ignorant of more important matters. 'Parva leves capiunt animos.' The lying-in room should be kept cool, and the nurse and one or two female friends are sufficient for every purpose. Whispering, and indeed every circumstance calculated to excite alarm and apprehension, of which parturient women are extraordinarily susceptible, should be avoided. There is no reason why simple and nutritious food should be forbidden: stimulants and spice are injurious, excepting when the labor is tedious, and when exhaustion is delaying the delivery, in which case wine alone, or wine and water according to previous habits, may be allowed. Sleep should be encouraged in the intervals of pain; and cheerful lively conversation is productive of good.

220. The practitioner is occasionally to leave the room, to afford an opportunity for evacuating the bladder and rectum. In the first stage of labor, which is usually attended with frequent, sharp, cutting, and grinding pains, the woman need not be confined to the bed, she may walk about the room, and place herself in any posture which is most easy. In this stage there is no necessity to examine frequently, as the head cannot be expelled till the os uteri is dilated. Afterwards however, when the head is advancing towards the outlet, we must frequently inform ourselves of its progress, and prevent as much as possible that restlessness and irritability of the patient, which, even under Dr. Denman's management, was once the cause of laceration of the perinæum. Cramps, which are occasionally arising from pressure on the obturator and sciatic nerves, are favorable, inasmuch as they indicate the rapid descent of the child through the pelvis. Vomitings, shiverings, and rigors, are often occurring during the dilatation of the os uteri; and, as they are proofs of the sympathy of the system with the uterine action, they need not excite alarm. It is seldom necessary to employ any remedies for their removal: if the vomiting be very severe, you may give the saline effervescent mixture; and if symptoms of pyrexia, with affection of the head, follow the rigors, more especially if the pulse be high and the arteries about the head throb, the abstraction of sixteen, twenty, or even five-and-twenty, ounces of blood from the arm will be very desirable.

221. Children, though not dead, are sometimes still born, or they are incapable of crying, and of manifesting other indications of vitality. This effect is generally produced by pressure on the umbilical cord, or, where the head has been long jammed in the pelvis, it may arise from compression of the brain. Three modes of resuscitating the child, when still born, have been proposed: pressure on the ribs, blowing into its mouth, and the performance of artificial respiration by the tracheal pipe. The first is to be effected by pressing down the ribs, which are very elastic, so as alternately to enlarge and diminish the capacity of the chest, thus keeping up an imperfect artificial respiration. This mode of procedure we have adopted several times, but in vain, as it is not probable that much air enters the lungs. The second method, or that of blowing into the mouth is very inefficient, as, with the utmost care, it is doubtful whether you can inflate the pulmonary cells. The tracheal pipe is the only instrument by which we can so effectually fill the lungs as to afford any satisfactory prospect of resuscitating the child. The warm bath may ever be regarded as a most powerful auxiliary. Le Gallois removed the head of a rabbit and secured the vessels of the neck; the animal seemed dead, but, when artificial respiration was commenced, signs of vitality were soon

apparent. The heart acted; the circulation was again carried on; and muscular irritability was renewed throughout the whole system. Thus in a decapitated animal, by means of artificial breathing, he maintained for one, two, and three hours active vitality. No stronger proof can be adduced of the efficacy of pulmonary inflation, in renewing and supporting the action of the heart and arteries. In performing this artificial function for new-born children, it has been frequently observed, that, while the respiration was continued, the cord pulsated, ceasing to beat in a few seconds when the operation was suspended. The tracheal pipe, is a little tube of silver, designed to pass into the trachea, its end closed like a catheter, with a long broad fissure on either side, to give free vent to air and mucus. In order to introduce this instrument, pass the forefinger of the left hand down upon the root of the tongue, and into the rima glottidis; and then, taking the tube with the right hand, slide it along the surface of the finger, till reaching the rima, when the tube is to be inserted into the trachea, immediately the finger is withdrawn, afterwards feeling on the front of the neck, whether the instrument is lying in the trachea or œsophagus. This done, the child may be taken into the hands of the accoucheur, and from his lungs the lungs of the child may be inflated. Operating in this manner the artificial respiration may be executed with the best success. A woman, whose case we recollect, having been run over by a coach, was carried into St. Thomas's Hospital, and died in a few minutes after admission. She was at the end of pregnancy, and the Cæsarean operation was performed by Mr. Green in thirteen minutes from the last respiration of the mother; the child was taken out, and, in fifteen minutes from the last respiration, Dr. Blundell began the artificial respiration. During fifteen minutes longer it was continued, ultimately completely resuscitating the child. Mr. Tomkins of Yeovil once used resuscitants for an hour and five minutes by the watch, before obvious signs of life appeared, the child recovering at last and living for some time.

222. *On hæmorrhage occurring immediately before or immediately after the birth of the child.*—We have already remarked that the third stage of parturition is the most important, and involves the most momentous consequences. The birth of the child, in natural labor, is generally accomplished by the natural efforts; and, if we except the protection of the perinæum, no exertion is demanded from the practitioner, beyond what sound discretion will readily enable him to bestow. This, however, is far less frequently the case in relation to the placenta; for, without any error on the part of the accoucheur, partial detachment of this viscus, giving rise to alarming hæmorrhage and irregular contraction of the uterus, detaining the placenta in its cavity, may occur. After a well conducted natural labor we generally find, in fifteen or twenty minutes from the birth of the child, that uterine pain is again returning; and, if we pass the finger along the course of the funis, we shall probably discover the placenta lying either low down in the vagina, or at the os uteri. In these circumstances, the slightest bearing on the funis secures the birth of the placenta; and, as its situation in this case presupposes the complete contraction of the uterus, we need only remark that its extraction is to be conducted with delicacy and care. The contraction of the womb is the basis on which we must found all rules for the extraction of the placenta, as well as all pleasing expectations of the future safety of the patient. By this process the womb not only diminishes its internal surface, but, in a greater or less degree, it acts upon and expels its contents, and subsequently secures itself from the risk of hæmorrhage and inversion. The various conditions in which the uterus is found, after parturition, are dependent on the more or less powerful exertions of this principle. Where we find the uterus circumscribed, round, and hard, we know that contraction has taken place; and that neither flooding nor inversion is likely to occur. Where, on the contrary, the uterus is large, lax, and soft to the feel, its parietes being so ill defined as scarcely to enable us to ascertain its precise dimensions, we must proceed with the utmost caution. There are other conditions, varieties of these, in which the womb may after delivery be found, but as they will only require a modified treatment we shall not particularly describe them. A diversity of management in these different states has been instituted; and, observing the fatal consequences which followed the artificial separation and delivery of the placenta, Buysch, Hunter, and Denman recommended in all cases after the birth of the child, that the expulsion of the placenta, like that of the fœtus, should be committed to the natural powers; believing 'that the same natural powers which were adequate to expel the child, were also adequate to expel the placenta.' And we can easily conceive where women live in a savage and barbarous state, that little danger will ensue. Experience has however proved that, if the expulsion of this important viscus be left to the unaided powers of uterine contraction, patients frequently die. The practice has been tried both in Holland and in this country, and is now we believe entirely laid aside. Different rules have been prescribed as to the precise time when artificial assistance is to be rendered. Hunter and Denman regulated their interference according to time; and, if the placenta did not come away within four hours after the birth of the child, they conceived themselves fully warranted in the employment of manual assistance.

223. Other practitioners have formed their criterion of interference from the degree of pain, and the situation of the placenta in the uterine cavity. These rules are all individually good, but if a determinate one is to be formed, or as near an approach as possible to a fixed law of procedure is to be attempted, much freedom must be allowed to the exertion of individual judgment and discretion. In the slighter cases of hæmorrhage after labor we should not enjoin a hasty delivery of the placenta; if we wait twenty or thirty minutes, the uterus will in some degree have recovered its tone, the circulation of the mother will be less hurried, and the removal of this viscus will be accomplished with less subsequent risk. We need scarcely say that, before commencing any attempt at removal,

we must ascertain distinctly whether there be another child. If there be twins, there may be a common placenta, and its abstraction before the birth of the other child might be productive of suffocation to the unborn fœtus. Having determined to extract the placenta, and having placed the woman on her left side, we may lay hold of the umbilical cord with the right hand, passing two or three fingers of the left into the vagina, so as to secure a bearing on the body of the placenta; and, if the pains are occurring at intervals, it is better to wait for and cooperate with these than to extract without them. If, however, they are wanting, we must draw down steadily in a direction from the umbilicus to the coccyx, securing each advance by a firmer hold of the funis: and, if the circumstances are such as to justify its removal, we shall seldom find much difficulty. We have now described the most simple case of extraction of the placenta, where there can exist little difference of opinion as to the propriety of the measure. And we would here again remark, that the placenta is much more readily and speedily separated from its uterine attachment, and that the uterus itself is much more likely to be found low in the abdomen, firm, circumscribed, and well contracted, if the latter part of the labor has been deliberately performed, than when, from an anxiety to terminate the process, the body and lower extremities of the child have been manually extracted, during the absence of uterine pain. It will occasionally happen, after the expiration of an hour or longer from the birth of the child, and when by external pressure, and the exhibition of some slight stimulant, we have endeavoured to excite the contractile efforts of the uterus, that it still continues high in the abdominal cavity, flaccid, ill-contracted and of large size. This condition may exist under two states of the uterus in relation to the placenta. The placenta may either be separated from its uterine attachment, and, remaining loose, cannot be excluded out of the cavity of the womb from a deficiency of contractile effort; or it may be morbidly or schirrously adherent to its internal surface, in which case we shall wait in vain for its natural expulsion.

224. We have already remarked that the placenta cannot safely be left for an indefinite period in the womb; and when we remember the solicitude of the patient and her friends, and the painful suspense which a retained placenta must ever excite in the mind of the accoucheur, and that it may be morbidly or schirrously adherent, we cannot entertain any doubt as to the propriety of its safe and timely removal. Dr. Ramsbotham, whose Practical Observations on Midwifery deserve a place in the library of every obstetric practitioner, says, that 'the introduction of the hand into the uterus, after the birth of the child, is, to use the mildest language, a harsh and severe measure: it always gives considerable pain, and it cannot be practised with impunity without some risk, present or future.' It must be acknowledged that this opinion is well-founded, that a meddlesome midwifery is bad, and yet, if any circumstances justify this measure, the retention of the placenta with loss of blood especially does so. An accoucheur cannot commence this most serious proceeding with too powerful an impression of the delicacy of the parts on which he is about to operate; and yet, if he conduct the extraction slowly and skilfully, he will not often have to regret its performance. We are somewhat disposed to believe that a share of the difficulty and danger, consequent on this operation, may depend on the length of time which is so often, through timidity or dread of the consequences, allowed to elapse before the commencement of the manual extraction; the womb having had time firmly to contract itself around those contents which are now to be considered as extraneous bodies, and as obstacles to its natural diminution of size. 'It will rarely be necessary to exceed two hours, before recourse be had to this proceeding; more frequently its necessity will be obvious before the expiration of this time; indeed, on an average of cases, it will be found that, if the placenta be not thrown off within one hour after the birth of the child, it is detained by some unusual cause. If hæmorrhage, or other pressing symptoms, suddenly intervene, an earlier removal will be required, otherwise every thing like hurry or haste ought carefully to be avoided.' Vide Dr. Ramsbotham's Observations, p. 57.

225. If then the placenta be retained after labor, by that irregular action of the uterus which has been denominated the hour-glass contraction, and hæmorrhage supervene, or if we have reason to suspect its morbid adhesion to the internal surface of the uterus, from the continuance of this latter organ in the state we have already described, and, from our inability to trace the progress of the end to its termination in the placenta, there is no other alternative than by the introduction of the hand to overcome in the one instance the contraction, when the placenta will generally be immediately expelled; and in the other, by the same means, carefully to separate its morbid adhesions. In order to effect this purpose the left arm should be bared, and well smeared with lard, the woman having been previously placed on her left side, with her knees drawn up towards the abdomen, and her nates at the edge of the bed. The accoucheur may sit on a low chair; or, which is much more convenient, he may kneel at the side of the bed. Having accomplished the introduction of the hand into the uterus, he will soon discover the cause of retention; if it arise from irregular contraction, whether it be of the longitudinal kind, or globe-like, he may advantageously apply the right hand over the uterine tumor externally, thus aiding his operations by steadying the womb, and preventing any rolling motion; the contracted part is to be slowly and cautiously dilated, till the hand can obtain admittance so far as to include within its grasp the whole or greater part of the placenta, when it may be gradually withdrawn. If the placenta be found partially or generally adherent to the inner surface of the uterus, the fingers must be cautiously insinuated between its edge and the womb, and carried forward till the whole mass is separated, when it may be removed as in the former case. It will not unfrequently happen that the contractile

efforts will be so violent as to impair the sensibility of the fingers, and indeed of the whole hand; in this case we may allow it to remain for a short time at rest in the uterine cavity, but we should, if possible, avoid its retraction, as its reintroduction will give great pain, and be attended with renewed risk. If the placenta be retained merely from torpor of the uterus, which often happens after laborious and protracted delivery, the stimulus of the hand within its cavity will generally induce a sufficient return of contractile effort for its entire expulsion.

226. We have now dwelt at length on those floodings and their treatment which are occurring between the birth of the child and the expulsion of the placenta; and we are from experience disposed to believe that they generally arise from its greater or less adhesion to the uterine surface; nor are we aware of any measure to which we can look for safety, but to the introduction of the hand, inducing thereby contraction of the uterus, and the consequent expulsion of the placenta. We are not always so fortunate as to secure contraction, even where we have succeeded in bringing away this adherent viscus; for, a little time ago, we were compelled to watch a patient four hours in these circumstances, and during the whole time to maintain a griping, grasping action on the uterine parietes, thus preventing hæmorrhage.

227. *Flooding after the birth of the placenta.*—The first circumstance requiring attention after the expulsion of the placenta, supposing we are satisfied that there is not another child, is to insure firm and permanent contraction of the uterus. The patient is now to be kept remarkably quiet; and it is important, if she be prone to hæmorrhage, that stimulants should not be given. The condition of the uterus should be frequently examined, and even the slight grasping of its parietes by the hand will often be sufficient to maintain it in a state of firm and satisfactory contraction. The bandage is to be applied round the region of the uterus, tightened so much as to afford an agreeable feeling of support. It may so happen, however, that notwithstanding every precaution the uterus may become suddenly relaxed, and even under a very slight degree of relaxation, if the force of the circulation is extrordinarily great, it may, according to some cases published by Dr. Gooch, in the Medico-Chirurgical Transactions, be able to overcome the ordinary closure of the orifices, and thus a profuse hæmorrhage may arise, although the uterus be contracted.

228. Dr. Gooch has also noticed the fact of the alternate contractions and relaxations of the uterus in hæmorrhage, which every practitioner in midwifery must frequently have met with. Supposing the hæmorrhage to have been considerable, and the patient in a state of alarming exhaustion, with bleached face, and scarcely a perceptible pulse, it is evident there is no time to be lost, if the uterus does not contract, the flooding may recur, and the patient may soon be placed beyond the reach of remedies. In these cases, if the uterus is large and flaccid, we must not hesitate, after the exhibition of some powerful stimulant, as brandy or rum to apply cold vinegar and water to the pudenda and loins, and pounded ice to the abdomen. We have indeed seen cases where these remedies were not efficient in restraining the hæmorrhage; and we have in several instances, and with the best effect, dashed cold water from a considerable height on the naked abdomen. We shall subjoin the following cases as illustrative of the vigorous treatment which these floodings demand; we could add many more of the same kind, but here, and in subsequent parts of this treatise, we shall generally be satisfied with the insertion of one good example, illustrative of the practice recommended, as we feel assured where the cases are genuine, and the treatment correct, practitioners will verify and apply the rules by a reference to their own experience. Our great aim is to afford information which will be available at the bedside of the patient, and to render our observations essentially practical.

229. On the 4th of November, 1823, Mrs. ——, aged twenty-three, after a lingering labor of twenty-eight hours, was confined of a girl, her first child. The head was large, and from extreme rigidity of the parts, and the severity of the expulsatory pains, she had suffered greatly before its birth; previously to the extraction of the placenta the abdominal bandage was applied, and she expressed much pleasure at the support it afforded. After fanning her, and giving a little simple gruel, the pains recurred, and the placenta was low down in the vagina before its extraction was attempted. Immediately after its removal she lost perhaps a pint of blood; but the uterus contracted well, and she remained tolerably tranquil for twenty minutes. The uterine parietes were now most suddenly relaxed, and an alarming quantity of blood was impetuously pumped out. Cloths, wetted with the coldest water, were thrown rather forcibly on the abdomen, pudenda, and thighs; a draught of the coldest spring water was swallowed, the bandage was tightened, and the uterus griped by the hand. These measures restored her from a state of collapse and syncope, and induced firm contraction of the womb, which might now be felt as large as a child's head, and almost as hard. She progressed very satisfactorily for a full hour, when, having left the room for a few minutes, we were hastily summoned to the patient, whose appearance was very alarming. The eyes were closed, the lips colorless, her extremities cold and thrown out, as in the last act of life, and the action of the heart was scarcely perceptible. Several pints more blood had been lost, and, without waiting a moment, we dashed from a considerable height a large ewer full of cold water on the naked abdomen; poured several wine-glasses full of nearly pure brandy down the throat, and determined to trust no longer to the continuance of uterine contraction. The uterus was once again small, and both the hands of the accoucheur were now applied to its parietes, keeping up such griping pressure as was necessary to insure a continuance of its contractile action. By the aid of the nurse, and two female relatives of the lady, we maintained this manual pressure for six hours, after which no further hæmorrhage

ensued. This patient had a very protracted and painful recovery.

230. It is worthy of remark, in this case, that the hand was not introduced into the uterus, and, where coagula are not preventing the contraction of this organ, we think the means now described will generally put a stop to the hæmorrhage without resorting to this objectionable and hazardous proceeding.

231. Mrs. ——, aged twenty-seven, was confined on the 4th of July, 1824, of her first child, after a labor of only a few hours duration. The practitioner in attendance, before we saw the patient, stated that the uterus contracted well after the expulsion of the placenta. Four hours after labor the nurse discovered she was flooding, and requested the attendance of her accoucheur, who applied cold cloths, and, supposing the flooding to have stopped, took his leave. On examination of the abdomen we were astonished at the bulk of the uterus, and from the exhausted and powerless state of the system, we were convinced that the internal hæmorrhage was large and alarming. The hand was passed into the uterine cavity, and at least three or four pints of coagula were removed, after which the uterus powerfully contracted. This did not continue long; relaxation again occurred, and more blood was lost. Brandy, and the griping of the uterus for two hours, permanently restrained all further hæmorrhage; of course the abdominal bandage was applied. This lady continued in a precarious state for some days, and was very long in regaining her strength.

232. For patients predisposed to hæmorrhage during labor we have been for some years in the habit of prescribing a less nutritious diet for one or two months preceding confinement; and in one case, which it is not important fully to detail, we have, before two successive confinements, taken away sixteen ounces of blood with decided advantage.

233. Some able remarks of Dr. Gooch in the paper to which we have already referred, so entirely coincide with circumstances of daily occurrence, that we shall present them in his own words. 'I could easily understand that a contraction of the uterus, which would preclude hæmorrhage in the ordinary state of the circulation, might be insufficient to prevent it, during violent action of the blood-vessels; and the inference I drew was, that in cases of hæmorrhage dependent not on want of contraction of the uterus, but on the want of tranquillity of the circulation, a mode of treatment which would produce a cool skin and a quiet pulse would be the best for presenting a recurrence of these floodings. How often a disturbance of circulation plays an important part in uterine hæmorrhage it is difficult for an individual to know; but I suspect sufficiently often to deserve the especial attention of practitioners. I advise them, when they meet with patients subject to hæmorrhage after delivery, to notice the state of the circulation before labor, and, if disturbed, to employ means for tranquillising it before labor comes on. I advise them during labor to use cordials cautiously, lest the placenta should separate during an excited state of circulation. I advise them, after delivery, though the uterus may feel contracted, to be slow to leave their patient if the circulation be greatly disturbed.'

234. In the concluding part of this paper Dr. Gooch recommends a practice, in which, without greater qualification than he has annexed, we cannot coincide. We refer to his opinion 'that when hæmorrhage occurs after the removal of the placenta, the quickest way to stop it is to introduce the left hand closed within the uterus, applying the right hand open to the outside of the abdomen, and then between the two to compress the part where the placenta was attached, and from which chiefly the blood is flowing.' We are aware that, in alarming and desperate floodings, any measure, however severe, is justifiable; the intention is to save a life which appears on the very point of extinction, and after consequences must yield to this momentous purpose. We do not deny that as a 'dernier resort' the carrying of the hand into the uterus may be absolutely necessary; but we are equally convinced that the griping or grasping pressure of the womb commenced immediately after the birth of the placenta, when there is an habitual proneness to flooding, or when the contraction of the uterus is unsatisfactory, will generally supersede its employment. The introduction of the hand into the uterine cavity is always attended with risk, and it cannot be less so when, owing to the exhausted and powerless state of the system, the uterus and vagina may easily suffer rupture or laceration. It may too be urged against this practice, when it is performed during syncope or approaching collapse, that it must of necessity destroy coagula or clots which are forming about the mouths of the bleeding vessels, and may thus originate fresh hæmorrhage. Briefly then to recapitulate what we have advanced, on this deeply interesting subject, we remark that, immediately on the birth of the child, flooding may arise; that it may depend on torpor of the uterus, rendering it incapable of expelling the placenta, or on the schirrous or otherwise morbid adhesion of this viscus to the internal uterine surface; that a variety of circumstances as to the time and manner of interference are demanding consideration; and that, while the bestowment of hasty and unnecessary assistance is to be deprecated, it should not be withheld for more than two hours, and when the hæmorrhage is alarming immediate extraction is necessary.

235. After the birth of the placenta, dangerous floodings, and these are by far the most numerous, may also arise; notwithstanding every effort to tranquillise the circulation, and to induce uterine contraction. In these cases we are to apply the abdominal bandage, and cold washes to the pudenda, thighs, and loins, to maintain a constant griping pressure externally on the uterine parietes, and to support the vital powers by stimulants, if necessary, in large quantities; if these fail, we may inject cold water into the uterus, and as a last expedient, by the introduction of the hand into its cavity, excite contraction; in addition to all measures, we must strictly enjoin wherever there is serious flooding the most entire and absolute rest, not even allowing a change of posture if it can by any means be avoided.

236. *On transfusion.*—The subjoined remarks are copied from the lecture of Dr. Blundell on this subject, as published in the Lancet.

237. If transfusion, with all its defects and excellencies about it, should be found hereafter to be as safe as other received operations of surgery (venesection for example), it may then, I conceive be performed in those cases where there have been large discharges of blood from the uterus, although the danger arising from the inanition may not be very imminent. In the present state of knowledge, however, and until we have further proofs of its efficacy and safety, in cases which are not desperate to appearance, I should not recommend the operation of transfusion; but if you have under care a patient in whom the flooding has been copious, in whom further the womb has been emptied, and the hæmorrhages stopped; should this woman, as I have myself on several occasions seen, be sinking gradually into the grave, so that, even to those who have seen much of floodings, the case appears to be without hope: under such circumstances, I affirm, that it is highly proper to have recourse to the operation of transfusion, provided we are competent to perform it.

238. In performing this operation, which I shall presently explain to you more at large, it is not necessary you should inject any very copious quantity of blood; for, in the present state of our knowledge, it would be unwise to endeavour by large injections to raise the patient at once from a moribund condition to a state of vigor. What is the ordinary average measure of blood required, in order to turn the trembling balance in our favor, has not as yet been clearly ascertained by facts and observations. From what little I have observed, however, I should suppose that from half a pint to a pint may be considered as a very ample supply; and I feel persuaded that, of those women who have sunk under floodings, the greater number would not have been lost, could they but have retained the last ten or sixteen ounces of the blood which they have lost.

239. Although I have said an operation of this sort is not to be rashly prescribed, and although in the present state of knowledge it ought to be confined to those cases only which, according to our honest judgment, must be considered as desperate without it; yet let me add further, in the way of caution, that where there is need of the operation it is obvious the sooner it is performed the better. I have myself seen two women die, whose lives, I feel persuaded, might have been preserved to society, had transfusion been more promptly begun. Anxious to refrain from the operation, while there remained a hope of life without it, I delayed the use of the syringe so long that, before transfusion could be commenced, the patient in each instance was breathing her last.

240. To give you a summary then of what appears to me to be important on this point, I conceive that under the large eruptions of blood from the uterus, if well managed, in general (say in nineteen cases in twenty) your patients, though they may alarm and shake your nerves, will nevertheless ultimately do well, and transfusion will not be required. I maintain, however, notwithstanding what is asserted to the contrary, and I boldly maintain, for I am irresistibly borne out by facts, that under the best and most judicious treatment, and certainly under treatment of average excellence, dissolutions may occur, sometimes so suddenly that you have not time to act; more frequently in a gradual manner, so that you see the patient sinking slowly, by little and little, into the grave. Now, in cases of this kind, when the patient is sinking gradually, I am not sure that transfusion might not be proper, even though the ovum were still in the uterus; but certainly such cases are not adapted to the splendid success of the operation, for, so long as the womb is unemptied, the bleeding may return, and the blood may be lost again as soon as it is injected; but when the uterus has been emptied, and the hæmorrhage has been stopped (and of all the cases these are the most common); then under the conditions stated the syringe should be tried, provided the case be obviously desperate without it; provided too you feel conscious that lying in the situation of the patient you would wish the essay to be made on your own person. The operation once obviously necessary, beware of delaying it too long; beware of subjecting yourselves to the painful mortification of seeing your patient perish at the entrance of the port; sink at the very moment when you are at length prepared with the very operation that might have saved them. From six to ten ounces of blood will probably be sufficient to turn the wavering balance in our favor. From one or two friends, males in preference to women, this supply may be obtained; a large injection is not desirable; reaction of a lively kind will sometimes come forward on the subsequent day. Adhere to these rules, and you cannot wander far from the line of duty; and let me ask now where is the folly, where the enthusiasm of all this?

Class I. Order 2.—*Lingering labor.*

Dystocia diutina: Merriman.—Lingering labor: Smellie.—Slow and painful labor: Watts.—Lingering and perplexing labor: Cooper.—Tedious labor: Burns. Class IV.—Difficult (but natural) labor: Hogben.—Dystocia protracta: Young's Nosology, Class V.

241. When we consider the circumstances attendant on human parturition, that certain expulsory powers are required to bring about the birth of a child, which of necessity implies a principle at least of passive resistance, we can easily understand that on the degree of harmony or want of accordance existing between the two will depend, in a great measure, the natural or difficult character of labor. We accordingly find that lingering labor, so called from being protracted beyond twenty-four hours, and yet ultimately terminating with safety to the mother and without instrumental aid, is mainly dependent on two causes: defect of pains, or in other words deficiency of the expulsory power, and increased resistance to the passage of the child.

242. Defect of pains or expulsory power may arise from original or acquired weakness of system, and in labor it will be characterised by unsa-

ficient, irregular, or partial action of the uterus. Increased resistance to the passage of the child is principally produced by the rigid and undilatable condition of the os uteri and external parts, the large size of the fœtal head, and the want of conformability in its bones, or on the small size of the pelvis, associated with an unyielding condition of the os coccygis. Monstrous formations of the fœtus do not admit of the application of regular rules; for, when these unfortunate deviations do occur, they are not constructed on any established principles, and their management must of course be left to the skill and judgment of the practitioner. Extreme distension of the uterus by the liquor amnii, and extraordinary thickness of membranes enclosing it, admit of such easy remedy, by the measures already alluded to, that we shall not bestow upon them a distinct consideration.

243. In the treatment of lingering labor, where there is deficiency of pain from original or acquired weakness of system, great scope is afforded for the exercise of the patience and passive firmness of the accoucheur. The natural powers are often distrusted, where they ultimately prove themselves capable to accomplish the delivery; and where, if they have not been interfered with, the subsequent recovery will be very satisfactory. We cannot form a correct opinion of the degree of pain required in different cases of labor to complete the delivery. In some women the most powerful and continued efforts are necessary for the birth of the child; while in lingering cases, where there seems to have been scarcely any really good pains for twenty-four hours, we nevertheless find the head protruding at the external parts; and one or two rather severe efforts are sufficient for its expulsion. We are always unwilling to hasten the progress of lingering parturition, if symptoms of debility, of cerebral affection, or of pressure on the parts themselves, do not indicate the necessity for interference. In some patients there is so little irritability, so little anxiety about the protraction of the labor, if the circumstances of delay are candidly and judiciously stated, that we are not at all induced to employ any stimulant remedies. In other women, the converse of this statement is true, and they will more quickly require assistance.

244. The patient's strength must be supported by mild nourishment, such as beef-tea, veal-broth, &c. These, however, so often produce flatulence and uncomfortable distension of the stomach, that small quantities of solid food, as sandwiches, at proper intervals, are sometimes preferable. Dr. Hunter used to say in his lectures, that he had attended a patient three days and nights and one whole fourth day, the woman crooked and the child large. She lived all the time on tea and gruel only. Dr. Merriman appends the following remark, 'had the doctor allowed this patient cordials and stimulants, with a view of keeping up her strength, is it probable that the labor would have terminated so favorable?' We think that it would not; still there are cases where stimulants may be exhibited, and for this simple reason, that instrumental aid will be required if some safe impulse cannot be given to the uterine system. We are decidedly opposed to wine, or stimulants in any form at the commencement of labor, or to their injudicious exhibition during its continuance; but we have seen the happiest effects result from this treatment, in the protracted stages of lingering labor. We were lately called to a case, and requested to use instruments, where the patient had been forty-eight hours in labor of her first child; the parts had been rigid, and sixteen ounces of blood had been early abstracted; the head had rested many hours in its present situation below the brim, and pressing on the perinæum, and the pains were ineffective and at distant intervals. Here we encouraged the patient to hope for a safe delivery, ordered some solid nourishment, and port-wine negus; and in three hours the labor was safely completed, although the child was dead. The bowels should be cleared of feculent or other accumulations by mild aperients and clysters; the patient is not to be fatigued, and if the pains merely harass, and do not benefit her, she may take ♏xv. vel ♏xx. of the tincture of opium. Much larger doses than these have been recommended, and we have seen their bad effect in an entire suspension of uterine action.

245. In those cases where the os uteri is nearly or fully dilated, and where the head has remained in one position some hours, with ineffective pains, we may consider the action of the uterus arrested; and, if the means already pointed out are not successful in restoring its contractile energy, we may have recourse to the ergot of rye, which is universally allowed to increase the uterine pains, and consequently to hasten the delivery of the child. It is given in infusion; a dram, infused in a teacupful of boiling water for fifteen minutes, is the usual dose, and, if it should not produce any effect within an hour, it may be repeated. It has been considered very destructive to the life of the child; but from what we have seen of its effects, and from the extensive enquiries we have made, we are inclined to think that the death of the child in many of the instances ought in fairness to have been attributed to other causes, as the long continuance of the labor, pressure on the umbilical cord, &c. It does sometimes fail to produce any good effect; but this is common to all remedies; and when given before the head is in the cavity of the pelvis during rigidity of the softer parts, or where there is any deformity, we can easily conceive that the powerful contractive efforts to which it gives rise may induce serious injury both to the mother and the child. A most extraordinary circumstance, in relation to the ergot, is noted by Dr. Bibby of New York, that where the fœtus has been some time dead, and putrefaction to any extent has taken place, the remedy is altogether inert. In no case where it has been used has hæmorrhage occurred, and in natural labor when hæmorrhage does occur, it has been employed with great advantage.

246. Increased resistance to the passage of the child, which we have already enumerated as one of the principal causes of lingering labor, may be produced by the rigid and undilatable condition of the os uteri and external parts. These

are very trying cases, for the pains are sometimes so frequent and powerful as to render it necessary, for the satisfaction of the patient, that the accoucheur should be in attendance for hours before his assistance is really required. We are fully aware how constantly rigidity is the cause of tedious labor, and we believe that its treatment has not obtained perhaps all the consideration to which it is entitled; yet we cannot concur in the following opinion of Dr. Dewees, a distinguished American practitioner. See a valuable Practical Treatise on Midwifery, by Dr. Dewees, 1825. 'Writers have but very imperfectly considered the rigidity of the soft parts as a cause of difficult or tedious labor; some, indeed, do not mention it, and others do so merely en-passant. It is so common a case that every practitioner must have met with it; but it has failed to make a proper impression, because time and severe suffering have eventually overcome it, though not always with safety either to mother or child.' We cannot perceive that Dr. Dewees has thrown any new light on this subject; he has certainly recommended larger abstractions of blood (a practice previously enjoined by Mauriceau to a moderate extent), than we should feel disposed to adopt, unless the rigidity was extreme, the pulse very full and frequent, and the general tendency to inflammation and fever marked and decided. We trust we shall never hesitate to adopt the boldest and most vigorous treatment, when absolutely required; but as partial fatuity, in our opinion, has often resulted from the unnecessarily large abstractions of blood in apoplectic disease, so a painful and protracted recovery, with its attendant evils, will, we think, often occur, from bleedings to the extent of thirty forty, or even fifty ounces in these cases.

247. Were we called to a patient with rigidity of the softer parts, whose previous labors had been protracted from the same cause, we should consider venesection as the first in the series of remedies. In rigidity of a moderate kind, or during a first labor, we should first of all empty the rectum, whose feculent accumulations we have frequently known to obstruct labor. The bladder should not be distended, and the erect posture, short of fatigue, may be maintained; every thing is to be avoided at all likely to produce fever. Tea, toast and water, barley-water, milk and water, or veal-broth, may be taken; and the apartment should be airy and cool. We have twice rubbed in the belladonna, as advised by Dr. Conquest, but without any benefit: we have many times been much gratified with the effect of opiate clysters, or suppositories introduced into the rectum, even after opium has been taken internally, without any apparently good effect. Opium should not be given until the bowels have been relieved, and of course, if bleeding has been previously employed, it will be exhibited under the most advantageous circumstances.

248. The author of this paper some time since attended Mrs. ——, aged twenty-two, in her first confinement, the edges of the os uteri being much attenuated, very hot, not at all moist, nor disposed to dilatation. There was neither fulness of pulse nor heat of surface, beyond what is commonly occurring in the commencement of labor. The bowels were fully relieved by castor-oil, and the pains had been tranquillised by thirty minims of the tincture of opium. After an hour's sleep, she awoke refreshed, and the pains recurred. Eighteen hours had now elapsed since the commencement of the labor, and there was no alteration in the os uteri. A drachm of the extract of belladonna was rubbed about the cervix and os uteri, but, after waiting for two or three hours, there was no perceptible effect. The pains were very vehement and forcing, but the attenuated edges and heated condition of the os uteri still continued, and it was not dilated more than enough to admit the tip of the finger. A clyster composed of linseed tea and sixty minims of the tincture of opium was thrown into the rectum: it remained nearly an hour, and immediately on its expulsion two grains of solid opium, softened by mucilage, were insinuated into the bowel, just beyond the sphincter ani; very shortly afterwards the condition of the os uteri began to change, and, before the expiration of three hours from the giving of the injection, the head was protruding at the outlet. We have frequently since this period adopted the practice of giving opiate clysters and suppositories, and always with decided advantage.

249. Some practitioners, says Dr. Merriman, are fond of introducing lard or pomatum, in order to induce relaxation, but this never does good, unless the rigidity is confined to the vagina, or external parts, it may then be frequently used with advantage. The best method of using greasy applications in such cases is to have very good tallow, scraped and rolled up into a ball, about the size of a nutmeg; this should be carried by the finger as high as possible into the vagina; here it gradually dissolves, and is dispersed over the whole surface. It answers best in those cases where the natural mucus of the parts is either not duly secreted, or has been accidentally or incautiously separated.

250. The large size of the fœtal head, and the diminished capacity of the pelvis, oppose nearly the same obstacles to the full effect of the expulsatory powers of the uterus. It is manifestly impossible exactly to predetermine in what proportion the diminution of capacity of the pelvis may consist with the passage of the child's head, reduced as much as possible in bulk by the overlapping of the cranial bones; but we have seen the fœtal head so altered in shape, and so diminished in bulk, by the operation of this principle of conformability, as to induce us to wait for many days, provided no alarming symptoms arise, before we should class it amongst the difficult labors, and avail ourselves of instrumental aid. The elongated, squeezed, and sugar-loaf heads, which we so often see, and where although much compressed the child is yet born alive, must induce great confidence in the natural powers. It is a common remark, and without entirely assenting to its truth, we may repeat it here, that, after the most severe labors, women frequently have the best recoveries. Let the patient avoid stimuli, except by the permission of her medical attendant; let

her mind be tranquillised by an assurance of the probability of her welfare, and labor will very often terminate safely and well.

251. We wish, in concluding our remarks on lingering labor, to renew the cautions already expressed relative to rupturing the membranes. We have said that, to allow the membranes to be ruptured by the natural efforts is the rule; their artificial rupture the exception. We may now add, that the progress of labor may be sometimes accelerated by this procedure—

If the os uteri is fully dilated;

If the head, or a large portion of it, has fairly descended into the cavity of the pelvis; and

If the perinæum is thin and dilatable.

251.* The premature evacuation of the waters, occurring either spontaneously, or from the effort of the accoucheur, renders the woman extremely uncomfortable, as they may continue dribbling away for some days, attended by occasional harassing but unprofitable pains, the patient being kept in constant anxiety about the coming on of parturition. It is worthy of observation that laboı seldom occurs, in these cases, till the whole of the liquor amnii has passed off; but, when the contractile efforts of the uterus do supervene, the process is generally quickly terminated, and quite as safely as in other cases.

252. The funis may pass down with the waters, and descend below the head, and the protraction of the labor, which it was intended to avoid by the artificial rupture of the membranes, is frequently produced thereby, as the comparatively hard and unaccommodating head of the child is substituted for the soft and elastic bag containing the waters, in the process of dilating the os uteri and upper part of the vagina.

253. It is, therefore, very evident that the interruption of the natural progress of delivery, and the injudicious management of the attendant, may convert that which was natural into lingering, and perhaps difficult labor.

254. The indiscriminate exhibition of cordials, the inactivity of the woman herself, and the excitement of friends, is prejudicial. We must dissuade her from bearing down or forcing the pain, as it is termed, till the parts are prepared for the expulsion of the child; we must not irritate and inflame the parts by too frequent examinations; and we must not allow the bladder to become unduly distended.

Chapman, in his fortieth case, gives an account of a poor woman who died undelivered, in consequence of an over-distended bladder

Class I. Order 3.—*Twin labor*

Anomalous Labor, order 3:—Denman. Preternatural Labor, order 7:—Burns. Distokia Gemina:—Merriman. Plural Birth:—Aitken.

255. As it is universally allowed that no infallible criterion exists by which we can discover a plurality of children in utero before their birth, so it is a matter of congratulation that in their delivery we need not greatly deviate from those rules which govern the labors of single children. No difference of opinion can exist as to the birth of the first child; if it present naturally, it will of course be managed as a natural labor; if preternaturally it will require treatment suited to its individual case. It does sometimes happen that a part of the second child is combined with the presentation of the first, and thus the case is rendered clear, before the completion of the first birth. After this it is proper in every case, previously to any attempts for the extraction of the placenta, and more especially where we suspect a plurality of children, carefully to examine the abdomen, and, if we are not satisfied by such an examination, to pass two fingers to the os uteri, when we can scarcely fail to discover the precise case. Practitioners of midwifery have differed in several points relative to the birth of the second child, as to whether it should be entirely committed to the natural powers, or, if assistance be necessary, at what time it shall be afforded. These questions may be satisfactorily answered by an observance of facts, and the simplest deductions therefrom.

256. Obstetric science admits of great certainty in its practical details; occurrences of a general or of a peculiar kind may arise, and they may be met by general or peculiar laws; still, however, much must depend on the judgment of the accoucheur in individual cases. If the birth of the first child has been preternatural, or if it has required instrumental aid; if it has been succeeded by hæmorrhage, or complicated with convulsions; we see every reason why the expulsion of the second child should be accomplished with as little delay as possible; and if the converse of this statement were true as to the first child, and if the second presentation were natural, we should not hesitate, after recruiting the patient's strength, to rupture the membranes, the parts having been already dilated by the passage of the first child; and, if the presentation of the second child were preternatural, we should with equal solicitude make the earliest attempt to bring it into the world.

257. When both the children present naturally, and the labor of the first terminates without artificial assistance, we may properly wait for the occurrence of the next pains; if these, however, are deferred beyond an hour, we rupture the second set of membranes, provided the patient be sufficiently recovered from the first labor, and the second birth is seldom protracted, as all the softer parts have been previously dilated.

258. We have found great advantage from the application of the abdominal bandage immediately after the first birth, as, by gentle pressure of the uterine parietes, we induce a speedier return of the contractile efforts and more effectually prevent any subsequent flooding. A very singular case of complicated labor, from locking of the heads of twins, is related by Mr. Allan in the second part of the twelfth volume of the Medico-Chirurgical Transactions. Dr. Clough also published a curious instance of twins in the Medical and Physical Journal, both of which were discovered by the midwife, one presenting with the feet, and the other with the head. The labor advanced very slowly, on which account Dr. Clough

was called in. He found the feet and body of one child, with the arms down on each side, protruded through the external orifice, and assisted to extract the shoulders. Still finding a difficulty he examined again, and ascertained that the head of the second child and that of the first were in the pelvis together. By the efforts of the uterus, the head of the second child was expelled, and then that of the first: both had been long dead; the mother recovered. A greater number of twin than of single children die during infancy, and of quadruplets very few reach maturity.

The following statements and observations are extracted from appendix, No. 20, to Dr. Merriman's Synopsis of Difficult Parturition.

259. 'There seems to be a very extraordinary variety in the averages of twin and triplet births in different countries, and under different circumstances. Thus the average of twin births has been stated,

By Dr. Clarke, at the Dublin lying-in-hospital, as	1 in 56½
By Dr. Bland, at the Westminster Dispensary, ...	1 in 80
By professor Boer, in the Vienna lying-in-hospital, ...	1 in 80
By Dr. Denman, at the British hospital, ...	1 in 91
By Dr. Denman, at the Middlesex hospital, ...	1 in 93
By Mr. Burns in his own practice .	1 in 95
By Madame Boioin, at the Hospice de la Matenrité, ...	1 in 132
By Mons. Tenon, surgeon to the Salpêtrière Paris, ...	1 in 96

'Respecting triplets the averages are still more various: many accoucheurs, of very extensive practice, have passed through a long life without once witnessing three children at a birth.

260. 'Dr. Bland kept a very exact register of 1897 women delivered at the expense of the Westminster General Dispensary, among whom there was one case of triplets; while I held the office of physician accoucheur to that charity, about 3500 women were delivered, among whom I was twice called to triplet labors.'

261. In the first 18,300 women delivered at the British lying-in-hospital not a single instance of triplets had occurred; but there were three such cases among 20,357 women delivered at the Hospice de la Maternité, at Paris, and nineteen among 59,354 women at the Dublin lying-in-hospital, or one in 3124. The averages of four children at a birth can scarcely be ascertained, yet several such instances are known to have happened; and there are a few authentic histories of five at a birth. Dr. Osborn is said to have once witnessed an expulsion of six abortive ova; and Borellus asserts that, about three years before he published his second Century of Observations, the wife of a nobleman in Languedoc was delivered of eight at a birth. Borellus, it must be acknowledged, tells many other marvellous stories. Haller says upon the subject 'Non raró fœmina geminos fœtus parit; rarius paulo tres, neque unquam supra quinque.' *Physiologia*, 929.

Class II.—Difficult Labor.

Dystocia Transversa:—Merriman. Dystocia à fœtûs situ:—Sauvages. Preternatural labor:—Burns. Accouchement contre nature:—Baudeloque Gardien. Accouchement manuel:—Capuron. Unnatural labor:—Burns.

Definition.—See page 547.

Order 1.—Labors requiring manual assistance; when the nates, the superior and the inferior extremities present.

262. In this order of labors the early knowledge of the presentation is of great importance, and we are not aware of any other method by which it can be ascertained than by examination per vaginam. If, when the finger is at the os uteri, we cannot feel any part of the child, we presume there is something unusual in the presentation, and this opinion is strengthened, when during pain the membranes are thrust down into the vagina in the shape of a cone, there being still no distinct presentation. Under these circumstances a patient requires great attention from her accoucheur, as much of the facility of delivery will depend on the period when assistance is afforded.

263. The os uteri being deprived, except in the case of the presentation of the nates, of early dilatation, the first stage of preternatural labor will generally require a long time for its completion. It is evident that, in this order of labor, presentations of the arm alone, or perhaps when complicated with some other parts of the child, absolutely require turning. Presentations of the breech, and of any part of the inferior extremities, will pass through the pelvis, demanding little if any more assistance than some of the presentations of the head: indeed we are inclined to believe, with the exception of the greater risk to the child, that face cases are more difficult and painful than presentations of the breech. The operation of turning, the first great improvement in obstetric science, is one oftentimes of considerable difficulty, and always of some degree of risk. The precise time and circumstances under which it is to be attempted have excited much controversy, although the opinions of practitioners are now pretty unanimous on certain important points.

264. Where the os uteri is undilated, and the genital organs rigid, turning ought never to be attempted. Where however the os uteri is dilated, even if the vagina and the perinæum are only beginning to expand, turning may be attempted; as, under any circumstances, the vagina and the parts about the outlet cannot receive their full dilatation till the nates are making pressure upon them. Supposing the os uteri to be expanded, to the size of a dollar, turning with great care may if necessary be commenced. If the membranes are ruptured, and the liquor amnii has escaped, the contractile efforts of the uterus are more powerful, and, from its closer approximation about every part of the child, the difficulties of the operation are much increased. Our own practice, in these cases, is to make out as early as possible the presenting part, and, if the pains are at all powerful and frequent, not again to leave the patient, so that we may seize

the most favorable opportunity for the introduction of the hand. If the os uteri is not dilated, of course, we wait; and, if it continue rigid, we employ the means already prescribed to induce a contrary state. If, however, the mouth of the uterus is sufficiently expanded, and the other genital parts are at all in a favorable condition, proceed to the delivery, much preferring that the waters shall not have passed off.

265. For the following observations on spontaneous evolution, and the exvisceration of the fœtus, the author of this paper is indebted to his friend Dr. Francis Ramsbotham.

266. Since the time when Ambrose Parey adopted the comparatively safe and easy operation of turning the child, and delivering by the feet in arm and shoulder presentations, the superiority of that mode of terminating the labor over others previously followed has been so generally acknowledged that it may be said to have become a universal practice. Few men in the present day will rely on the unassisted powers of nature for accomplishing the patient's release, and fewer still will attempt the dangerous and often impracticable expedient of returning the shoulder into the uterus and bringing the head to the pelvic brim.

267. Although the merit of having first suggested this improvement in practical midwifery be not conceded to Parey, still it must be allowed that he is entitled to our warmest praise for having by his recommendation made it generally known, and by his personal example proved its safety and its efficacy. So evident indeed are the advantages of Parey's operation that its revival and adoption may be considered almost an era in the history of midwifery.

268. It is not denied, however, that in some cases of shoulder presentation, the labor has been concluded by the natural efforts alone, unaided by manual interference. Dr. Denman was well aware of this fact, and has described the case as being a 'spontaneous evolution.' This talented and observant practitioner considered that a true evolution actually took place; he thought that the fœtus was too large to pass through the pelvis doubled; that the breech, being acted on by the continued uterine contractions, was gradually forced lower into the pelvis; and that at the same time the shoulder retreated into the womb, occupying the space which had been evacuated by the breech.

269. Dr. Denman's explanation was considered perfectly correct, and generally received by the profession, until Dr. Douglas of Dublin, in a pamphlet first published in 1811, proved that the description was inaccurate; he observes that it is incompatible with the received ideas of uterine action to suppose that the uterus, when contracting so powerfully as to force down that part of the child which was at its fundus, could at the same moment form a vacuum into which another portion already low down in the pelvis should recede.' The uterus indeed embraces and closely surrounds the fœtal body; the shoulder cannot recede either into the uterine or vaginal cavities, since the space evacuated by the breech no longer remains, but is destroyed by the continued uterine contractions.

270. To Dr. Douglas, therefore, we are indebted for a true history of the process. He has clearly demonstrated that the fœtus does pass the pelvis in a doubled position, describing a partial evolution indeed, and turning on the lowest point of the symphysis pubis as its centre.

271. He has given to the profession the following observations. 'In all the cases related by various practitioners, on the subject of the evolution, it is acknowledged that shortly before its occurrence the shoulder of the child had been forced very low into the pelvis; and that the thorax had occupied so much of its cavity as to preclude the practicability of the hand of the accoucheur being passed up into the uterus for the purpose of turning, as is usually done in such presentations. The shoulder and thorax, thus low and impacted, instead of receding into the uterus, are at each successive pain forced still lower, until the ribs of that side corresponding with the protruded arm press on the perinæum. At this period not only the entire arm, but the shoulder also can be perceived externally, with the clavicle lying under the arch of the pelvis. By further uterine contractions the ribs are forced more forward, appearing at the os externum, as the vertex would in a natural labor, the clavicle having been by degrees forced round on the anterior part of the pubes with the acromion looking towards the mons veneris.' The body of the fœtus then is bent into a curve; the head rests above the pubes internally; the clavicle presses against the lowest point of the symphysis pubis partly externally; the arm and shoulder are entirely protruded; the acromion is turned up towards the mons veneris; and a part of the side of the thorax closes the genital fissure. The abdomen and loins at the same time occupy the lower part of the pelvis, and the breech has either entered the pelvic cavity or lies at the brim ready to descend into it. By a continuance of uterine action the breech is expelled, sweeping the hollow of the sacrum, and distending the perinæum to a vast extent. It will be evident that, during this expulsion of the fœtus in this doubled form, the perinæum must be placed much more on the stretch than happens in a natural labor or a case of original breech presentation.

272. The spontaneous evolution is not to be expected where there exists a contracted pelvis; it can only take place when that cavity bears a large proportion to the size of the fœtus, and is most likely to happen under premature labor. From the pressure which the fœtal body must necessarily suffer it is not likely that the child will be born with life. Some cases, however, noticed by Dr. Denman sufficiently prove that the compression is not necessarily fatal to the infant. The longer the time occupied in the completion of the evolution, the more powerful the uterine exertions which are required to perfect it, and the smaller the mother's pelvis, the less probability will there be of the child's being preserved.

273. The knowledge that the delivery may possibly take place under the circumstances detailed above must be considered a great point gained in practical midwifery, since, in a few of those cases where the attendant is unable to in-

troduce his hand into the uterus in consequence of its firm contraction, he may trust with safety to the natural powers; especially if together with a small or premature fœtus there be a large pelvic cavity, strong uterine action, and an apparent disposition in the child to pass doubled. But, should these fortunate occurrences be wanting, he may have recourse to another mode much less likely to injure the mother than the forcible passage of the hand into the uterus under a state of strong and permanent contraction; namely, that of lessening the bulk of the fœtus, by taking away the viscera of the chest and abdomen, and afterwards imitating the 'spontaneous evolution,' or in other words extracting the body in a collapsed state.

274. Let it not be supposed that we should recommend this operation to supersede the common practice of turning under ordinary cases of shoulder presentation, but that it should only be resorted to by the practitioner in those rare instances when being called upon to deliver, perhaps many hours after the rupture of the membranes, he finds any continued attempts at turning would be attended with the danger of uterine laceration.

275. The operation is in itself easily performed; and the appalling feeling which every man must experience on perforating the head of a fœtus while ignorant of its life or death here can have no place; because the pressure on the child's body must have deprived it of vitality before the operation can have become necessary. The powerful objections, therefore, which obtain against the use of the perforator in general are not applicable in these cases.

276. No other instruments will be found necessary than the perforating scissors and the crotchet; the scissors are much preferable to the perforators in common use, as they possess a cutting edge both externally and within; with them, therefore, the separation of the viscera from their attachment is more easily effected.

277. The woman having been placed on her left side, the position most suitable for the performance of all obstetrical operations, as large an aperture as possible must be made into the chest at the most convenient part, by the division of one or more ribs; and through this opening the heart and lungs must be extracted, the diaphragm must then be perforated, and the liver may be easily removed; the intestines also may be drawn out without difficulty. The bulk of the fœtus being thus reduced, the body will collapse; and, if the uterine efforts continue, the evolution as described above will most probably speedily occur. Should the pains, however, have ceased, and the breech not descend after the removal of the viscera, the crotchet may be introduced through the aperture, and fixed within on some point of the fœtal pelvis; sufficient force may then be applied to extract, and the breech will be protruded, sweeping the sacrum and perinæum.

278. This operation Dr. Francis Ramsbotham thought it right to perform three times, and he has been present on two other occasions when it was had recourse to; nor has he found any particular difficulty attending it.

279. The separation of the head from the body at the neck is another mode by which delivery may be effected in cases of shoulder presentation, when the contracted state of uterus prevents the child being turned. In the case requiring this, as well as the preceding operation, the death of the child must have already taken place, and the objections against it are the difficulty of its performance, and the unsuitableness of the instruments which have until lately been proposed for the purpose. The scissors invented by the late Dr. Coombe have not been found to answer. The best instrument with which I am acquainted is a cutting hook made some years since by Dr. Ramsbotham Senior, of which a correct representation is given in Dr. D. Davis's excellent work on Instrumental Midwifery. This instrument possesses the curve of a large sized blunt hook; its cutting edge extends throughout the inner side of the whole curve to within half an inch of the extremity; and it is intended to be introduced over the neck, being carefully directed by the finger. When applied it is to be used as a saw, and by a gradual pressure downwards, the vertebræ and soft parts are divided.

280. On the separation of the head being effected, the body may be extracted by means of one or other of the arms, and should the pains have subsided the head may afterwards be extracted by a blunt hook or crotchet introduced either into the foramen magnum or the mouth. The possibility of any injury being inflicted on the soft parts of the mother may be prevented by the index finger of the left hand being kept against the blunt extremity of the instrument during its action.

281. Should the pelvis be filled by the fœtal chest, or abdomen, exvisceration will be most expedient; if, on the contrary, the neck originally presented over the centre of the brim, which must very rarely occur, the best mode of proceeding will be to decapitate the child. In one instance, in consequence of the narrowness of the pelvis, even after the child had been completely exviscerated, the body would not pass; we were therefore obliged to separate the head before extraction could be effected.

282. *Of the presentation of the nates.*—Many causes have been assigned for transverse or cross labors, such as the obliquity of the uterus, the shortness or the circumvolutions of the funis round the body of the child, and shocks affecting the mother during pregnancy. It is, however, very doubtful whether any of these circumstances influence the precise situation of the fœtus, as we have frequently met with every one of these occurrences, and still the head has been the presenting part. We are more disposed to attribute them to some peculiarity in the manner of descent of the ovum into the womb, or to some disproportion existing in the earliest months between its various parts.

283. An early examination will generally enable us to discover the presentation before the rupture of the membranes, and when the superior extremities lie over the centre of the pelvis, this is of no small importance. The breech may be distinguished by the pulpy softness of its feel, by the cleft between the buttocks, by the parts of generation, and sometimes by the dis-

charge of the meconium with the liquor amnii. The head, and more especially the face, is sometimes confounded with the breech. The roundness and hardness of the head, together with its sutures and fontanelles, and the inequalities of the face, will enable us to form a correct diagnosis between the two parts.

284. Labors, where the head of the child did not present, were as we have already seen in the history of obstetric science, much dreaded; and till a very much later period than the time of Celsus, thrusting up the part, and endeavouring to bring down the head, was the common practice. Celsus gives the following recommendation:—'Et si clunes os uteri urgere cæperunt, iterum retro repellendæ sunt, conquisitusque. pes ejus adducendus.' Portal, who practised with great celebrity in Paris, about 1668, entertained correct notions and gave very judicious directions for the management of presentations of the feet and nates. He says (chap. iv. p. 211), 'If the feet of the child come foremost, search the inward orifice of the womb, which if you find thick and not open as yet, you must not be too hasty, nor hazard any violent delivery of the child, but stay till the womb is sufficiently open to afford a passage for the birth. When the buttocks come foremost you must not be impatient; for, though the labor proceeds very slowly, yet it is not much more difficult than a natural birth: whence it is that our midwives say, by way of proverb, that where the buttocks can pass the head will follow of course. The position of the child in this case is doubled, with the thighs upon the belly; and the passage being once opened for the buttocks, by the reiterated pains, the head follows without much trouble; you must take hold of the feet as soon as they come out, and afterwards the head and shoulders.'

285. The erroneous and generally fatal practice, as to the child, of pushing up the nates, still continued: so difficult is it to shake off prejudices handed down from antiquity. Smellie was evidently doubtful both of the natural powers and of the standard capacity of the pelvis; in relation to breech cases we find him giving directions about stretching the external parts, dilating the os uteri, pulling down the legs, and raising and pushing up the nates. Dr. Hunter says, 'When I first began practice, I followed the old doctrines in breech presentations, although I did not like them, but yet dared not broach new ones till I got myself a little settled in life; at this time I lost the child in almost all the breech cases, but since I have left these cases to nature I always succeed.'

286. There is now no difference of opinion as to the propriety of leaving these cases to the natural efforts; for although the nates do not accomodate themselves so completely to the shape of the pelvis, yet they do not require so much room as the head; and if the labor, especially in its first stage, be allowed to proceed uninterruptedly, the nates will ultimately be protruded through the external parts; when the case must be managed as a footling presentation. We have seen many presentations of the nates; and although the protracted birth of the head, even when every measure had been employed to facilitate its expulsion, has rendered us less successful in the preservation of the child's life than Dr. Hunter, we are quite convinced that the preservation of the child will greatly depend on our little interference in the early part of the process.

287. *Of presentations of the inferior extremities.*—These have generally been regarded as the simplest and probably the safest of all the preternatural presentations, so far as regards the mother. The child, however, is in jeopardy, more particularly if it be a first labor, and the mother be rather advanced in life, and of rigid fibre. The foot may be distinguished from the hand, by the weight and resistance it gives to the touch, by the shortness and evenness of the toes, except the prominent great toe, and by the projection of the heel.

288. The early delivery of the head in these presentations is of vast importance, as, between it and the pelvis, the umbilical cord may suffer fatal compression. We are not to hasten the delivery of the child's body under the presumption that, by so doing, we diminish the risk of pressure on the cord; for on the contrary its slow passage dilates the parts of the mother, and affords greater space for the passage of the head, The rule therefore is, not to interfere till the nates are born; not to rupture the membranes; and supposing we are not called till the waters are evacuated, and the feet in the vagina, not even then by pulling them down to anticipate the effects of the natural pains. If, when the umbilicus passes beyond the os uteri, the funis descends further, a portion of it should be drawn out of the uterine cavity, that it may be stretched and compressed as little as possible when the head emerges from under the pubis.

289. If the nates are fairly in the world, the period to render assistance has arrived; and the rules for its bestowment are equally applicable to breech as to footling cases. A warm napkin, or flannel, is to be wrapped round the lower extremities of the child, and by swaying it a little backwards and forwards, or from side to side, its descent is facilitated. We have already explained the importance of the turn which the head makes in descending from the brim into the cavity of the pelvis in natural labor. In presentations of the breech and feet this turn is equally desirable; and if, when the nates have reached the external parts, we find the toes pointing towards the symphysis pubis, we know the head is unfavorably situated. Grasping the parts firmly, having previously covered them with a napkin, we wait for the next pain, and then we give such an inclination to the body of the child as shall direct its abdomen towards its mother's spine. Some practitioners have thought the arms ought not to be brought down, alleging that, while extended by the sides of the head, they prevent the os uteri from contracting round the neck of the child, and that by extracting them we endanger their dislocation or fracture. In these opinions we do not concur; for, if the early part of the labor has been deliberately conducted, the os uteri will generally be too fully dilated to allow of its contraction round either the neck or

the upper part of the child's head. It may so happen, if the pelvis be large and the head small, that the arms and cranium of the fœtus may with difficulty be brought away together; but as thus situated they occupy much room, producing delay and a compression of the softer parts, we prefer the previous extrication of the upper extremities. When, therefore, the axillæ of the child are on a level with the external genitals of the mother, the body of the fœtus must be placed completely out of the way, and two or more fingers may be passed to the bend of the elbow, when the arm may generally, with some little management, be brought down over the face. Having accomplished the birth of one arm, there is seldom much difficulty in getting away the other, and thus the passage of the head is facilitated. If, however, there are any obstacles to the birth of the cranium, and the uterine efforts alone are seldom sufficient for its expulsion, it is important that assistance should be speedily afforded, as compression on the cord will quickly destroy the life of the child.

290. For this purpose, we pass two or three fingers of the right hand over the nape of the neck, and insinuate a finger of the left hand into the child's mouth; by these means we depress the chin, alter the position of the head, and better adapt it to the pelvis; and, by a moderate extracting force, we bring forward the head, taking care lest by violence we injure the fœtus.

291. In cases of extreme difficulty the blunt hook is required; or a silk handkerchief passed over the bend of each thigh, giving us a complete command of the parts, may be employed; by either of these means we may, co-operating with the pains, draw down the nates to the outlet. We were lately called to a breech case by one of Dr. Blundell's pupils, in the management of which we had extreme difficulty. The woman was forty years of age, having a pelvis greatly deformed in its antro-posterior diameter. The waters had been evacuated many hours—the os uteri was fully dilated—the womb was contracting powerfully—and the breech might perhaps be considered as having just entered the cavity of the pelvis. She had three times previously been delivered by instruments. Hoping, however, that, as the breech occupies less space than the head, as she was a strong woman, and as no unpleasant symptoms had occurred, the breech might be thrust into the world by the natural efforts, we determined to give a few more hours for their full exertion. The bladder was emptied by the catheter, and the rectum was unloaded by a clyster. Six hours elapsed without any further advance of the presenting part, and we determined to use the blunt hook. Having fixed it successively in the fold of each thigh; and, having drawn down with the greatest caution for upwards of three quarters of an hour, very little progress had been made; nor was it till the point of the instrument was hitched over the sacro-iliac symhondroses that we could extract the breech. It ought to be stated that during the process there were intervals of rest, and the efforts at extraction were temporarily intermitted when the pulse was getting above 120 or 130: the child had been dead some days.

293. *Of presentations of the superior extremities.*—There are no cases in obstetric practice requiring a union of firmness and skill in a higher degree than presentations of the superior extremities. If they are discovered early, and their treatment be commenced under the most favorable circumstances, great tact and delicacy are necessary to avoid injury to the uterus and softer parts. And whether the hands, the elbow, or the shoulders present, they cannot pass through the pelvis without some alteration in their position. We have already noticed, as an era in obstetric science, the partial approximation to the present plan of treatment in the turning of a dead child by Celsus, although the principal merit of its revival and complete establishment, as an invariable rule, must be given to Ambrose Paré; who enjoins in all these presentations to turn the child and to bring it into the world by the feet; Dr. W. Hunter, believing that the parts would be much more dilated for the subsequent passage of the head if the breech was brought away first, instead of the feet, recommended to his pupils 'to introduce their hands into the uterus and gently to put up the arm and to turn the child to a breech presentation. Reduce it, if possible, to a perfect breech case, that it may come more gradually, on account of the head and navel string, lest you strangle the child. If, however, you find this impracticable, let it come footling, but sustain the child at the hips as long as you can, they being, next to the head, the largest and most unyielding part.'

294. If perfect agreement exist as to the way in which this operation is to be performed, there is great diversity of opinion as to the precise time when it shall be undertaken. Supposing we find the arm protruding through the os uteri, the membranes unbroken, and the os uteri fully dilated, there need be no hesitation. The arm of the operator is to be bared and smeared with some unctuous substance; and having, if they require it, gently dilated the external parts, the hand may be slowly carried to the os uteri, taking care to insinuate it through this part during the absence of pain. The membranes are now to be ruptured, and the hand will come in immediate contact with some part of the child. Having reached the feet, the operator must be careful so to draw down as that the abdomen of the child shall be placed towards the mother's spine. Continuing the extraction, the presenting arm will be gradually drawn into the uterus; and when the feet have cleared the external parts it becomes precisely similar to a presentation of the feet; and the rules already prescribed are applicable to its management.

295. Where the waters have been long evacuated before the practitioner sees his patient, the os uteri not fully dilated, and the pains vehement and quick, turning must not be attempted. We are aware that some practitioners do not concur in this opinion, urging that the uterus will most probably be ruptured by the continuance of the pains, the child remaining in this untoward position. The danger of rupture from delay, in this case, cannot exceed the risk of laceration, were the hand, for the purpose of turning, to be introduced into a uterus so powerfully contracting. In these cases, and we have seen

several, we bleed the patient if at all plethoric, to fourteen or twenty ounces, and follow up the abstraction, by sixty or eighty drops of the tinct. opii; by these means the uterine action will most probably be much diminished, and then the turning may be safely attempted. It may be urged that, although the uterus be not ruptured, yet the continuance of the pain will force the arm, the shoulder, or perhaps the head of the child so firmly into the uterus as to render it impossible to turn, even when its inordinate action has ceased. We are quite alive to the difficulty and risk which attends this jamming of the fœtus into the pelvis; but we think it less than what would accrue from thrusting the hand into this viscus when rigid, powerfully contracting, and irritable. The first case of turning we saw was one in which attempts had been made during the contractile efforts, to rectify the position of the child. Opium alone had been given, without any previous abstraction of blood. Three attempts proved unsuccessful, and eighty drops of laudanum were exhibited, the woman being undisturbed for two hours; after this period the child was extracted with ease, but the uterus had ruptured, and she died a few hours after delivery. The hands may be distinguished by their flatness, thickness, and breadth, by the length and inequality of the fingers, by the shortness of the thumb, and by the thumb bending into the palm of the hand.

Class II. Order 2.

296. Labors which cannot be completed without the aid of extracting instruments, of which some are designed to save the lives both of the mother and the child, while others are intended to preserve the life of the mother at the expense of the life of the child.

297. We have already considered lingering labor as dependent on one of two causes, either on diminished power, or increased resistance; and, when either of these exist to so great an extent as seriously to retard the progress of parturition, the skill, the promptitude, and the experience of the accoucheur are immediately in exercise. If after a fair trial of every expedient which the peculiar circumstances of the case may suggest, and after having allowed the fullest exertion of the natural powers compatible with the safety of the woman, the labor makes no advance, we must have recourse to instrumental aid. It is true that this necessity seldom arises; and we believe when the early stages of labor are well understood, where there is no undue interference, either from timidity or haste, the cases requiring the use of extracting instruments will be few indeed. Yet labors are occasionally occurring which cannot be terminated by the natural powers, where, from the disproportion between the pelvis and the head of the child, or from some deficiency in the expulsatory power, from the passions of the mind, or the diseases to which the human species are incident, the performance of duties is required from the practitioner, which he is solely enabled to discharge, because he has made midwifery a study, and is intimately acquainted, not only with natural but difficult parturition. These are the cases which distinguish the judicious accoucheur from the man who thinks that midwifery is undeviatingly simple and easy, and who at length discovers that he has neglected to acquire that knowledge without which the safety of his patients, and his own character, will soon be compromised. It is here that officious interference, neglect in the early stages manually to remedy a mal-position, the exhibition of stimulants under a mistaken idea that they impart strength, with many other errors equally pernicious, render that labor difficult and instrumental which, under other treatment, might have been concluded by the exertion of the natural powers.

298. Writers have been accustomed to enumerate a variety of appearances, which they have considered as presumptive signs of difficult labor; but the least reflection must convince us that as women of every form, of every complexion, and of the most diversified mental and physical powers and dispositions, have both natural and difficult labors, the knowledge of these supposed indications cannot be of any great importance in actual practice. A necessity for artificial aid is principally arising, first, from an excessive degree of those symptoms which have been already described under lingering labor; and which, from their continuance, induce such a powerless state of system as to call for the employment of instruments, intended to preserve the lives both of the mother and child; and, secondly, from distortion of the pelvis existing in every degree, from the slightest intrenchment on its capacity to absolute deformity, creating of itself a disproportion between the relative size of the fœtal head and the canal through which it must pass. It is needless to remark that these cases frequently demand the use of the perforator.

299. In the first kind of parturition the pains become weak, short, and inefficient, producing no effect on the head of the child; sometimes they are entirely suspended; and although their cessation within the first twenty-four hours does not justify the use of instruments, as it may be only temporary, yet if it occur at the end of the second or third day, if the pulse, the countenance, and the general appearance of the woman are expressive of extreme debility and fatigue, a strong presumption is afforded of the inability of the natural powers to complete the delivery without the assistance of art. If, in addition to these symptoms, we have shivering and vomiting, a pulse of 120 or 130, furred tongue, a hot dry skin, great thirst, restlessness, heat and soreness in the vagina and os uteri, we may feel assured our patient has approached to a state from the evil consequences of which instrumental aid will alone deliver her. The forceps will now be required; and, before we pass on to the next variety of labor, we shall describe the manner of its application, first enjoining a few preliminary measures. The forceps is an instrument intended to lay hold of the head of the child in difficult labor, and to extract it as it presents; and, as now improved, in the hands o a prudent and cautious operator, it may be employed without doing the least injury either to mother or child.

300. The bladder and rectum should be pre-

viously evacuated, not only to enlarge as much as possible the capacity of the pelvis, but to prevent the risk of injury to these parts themselves.

301. The first stage of labor must be completed, and the os uteri and perinæum in a dilatable and yielding condition, ere we think of employing instruments. It is a rule in the use of the forceps to be entirely guided by the circumstances of the mother, or rather no attempt must be made to save the life of the child when the mother may thereby be placed in jeopardy. The assistance given by instruments should co-operate with the contractile efforts of the uterus; and, if the pains have entirely ceased, intervals of rest must be observed; and it will be attended with advantage to watch the pulse, and to pause when it is exceeding 125 or 130.

302. The extracting efforts should always be made in the direction of the axis of the pelvis; so if we are employing the long forceps, and the head is above the brim, we should draw down in a line towards the coccyx; but, when the head is approaching the outlet, the direction of the extracting force must be forwards, or towards the pubes. The time occupied in instrumental deliveries greatly varies; for, while some may be safely terminated in a very short time, others require perhaps an hour for their completion. The usual obstetric position will do sufficiently well for instrumental purposes; the nates should be brought close to the edge of the bed, and the knees should be drawn up at right angles with the abdomen. When we can feel the ear in a vaginal examination, the case is manageable by the forceps; as its blades, being twice the length of the finger, will embrace the head. Dr. Denman, whose invaluable aphorisms on this subject ought to be consulted by every obstetric practitioner, says, the difficulties which attend the application and use of the forceps are far less than those of deciding upon the proper time when, and the cases in which, it ought to be applied. We may subjoin to this remark that, except where syncope is occurring from hæmorrhage, the ear may have remained in this situation some hours before the forceps is absolutely required.

303. The instruments now in use are:—

1st. Those intended to save the life both of the mother and the child; they consist of the

Short forceps,
Long forceps,
Vectis, and
Blunt hook.

2d. Those in the use of which the life of the child is sacrificed to the safety of the mother; they are the

Perforator,
Craniotomy forceps,
Crotchet, and
Scalpel.

Cases of the powerless labor such as we have already described, presentations of the vertex, and of the face, forehead, and ear, are all manageable by the forceps or lever, if circumstances do not exist rendering the employment of the perforator necessary.

304. There is no occasion, says Dr. Denman, and it would be hurtful to attempt, to change the position of the head when the forceps is applied, before we begin to extract. For, if the action with the forceps be slow, the head of the child will turn in the same manner, and for the same reasons, as in a natural labor. Therefore the forceps, being fixed upon the head, must also change its position according to its descent, and the handles be gradually turned from the ossa pubis and sacrum, where they were first placed, to the sides of the pelvis. The handles of the forceps likewise, though originally placed far back towards the sacrum, that is, in the direction of the cavity of the pelvis, will be gradually turned, as the child advances, more and more towards the pubes, that is, in the direction of the vagina. The first action with the forceps must be to bring the handles, firmly grasped in one or both hands, slowly towards the pubes, till they come to a full rest. After waiting till the pains return, or an imaginary interval if there should be a total want of pain, the handles are to be carried back in the same slow and cautious manner till the lock reaches the perinæum, using at the same time a certain degree of extracting force. The subsequent actions must be from handle to handle, or occasionally by simple attraction; but the action of that blade which was towards the pubes must be stronger and more extensive throughout the operation than the action with the other blade, which has no fulcrum to support it. By a repetition of these actions, always directed according to the position of the handles, with their force increased, diminished, or continued, according to the exigence of the case, we shall, in a short time, perceive the head of the child descending. When the head begins to descend the force of the action with the forceps must be abated; and, as that advances, the direction of the handles must change by degrees more and more to each side and towards the pubes. The lower the head of the child descends the more gently we must proceed, in order to prevent any injury or laceration of the perinæum or external parts, which are likewise to be supported in the same manner as in a natural labor. In some cases the mere excitement occasioned by the application of the forceps, or the very expectation of its being applied, will bring on a return or an increase of the pains sufficient to expel the child without its assistance. In other cases we are obliged to exert very considerable force, and to continue it for a long time; so that one operation may be safely and easily finished in twenty minutes, or even a less time, and another may require more than an hour for its completion, and the repeated exertions of very considerable force. In some cases it happens also that the obstacles to the delivery exist at one particular part of the pelvis, and, when that is surmounted, the remainder of the operation is easy; but in other cases there is some difficulty through the whole course of the pelvis. Before the exertion of much force we are always to be convinced that a small or a moderate degree of force is not equal to our purpose. In every case in which the forceps has been applied it are not to be moved before the head is extracted, even though we might

have little or no occasion for it. When the head of the child is born the forceps is to be removed, and the remaining circumstances are to be managed as if the labor had been natural.

305. *Of the vectis.*—We have not space, in an elementary treatise like the present, to enter at large into the enquiry of which is the better instrument the forceps or the lever; we know that men well qualified to form an opinion have embraced different views of this question, arising probably from their individual skill in their employment. It must we think be allowed that the lever is a very powerful instrument, and if the soft parts of the woman be constituted its fulcrum, its use will be highly dangerous; notwithstanding it may be applied to any part of the head, and may be used earlier than the forceps, we think the forceps by far the better instrument.

Class II. Order 2.

306. We shall now detail a few particulars relative to those difficult cases of parturition, which, from the size of the head, or from distortion in the pelvis, can neither be protruded by the force of the natural pains, nor extracted by the forceps; and which consequently require the life of the child to be sacrificed for the safety of the mother. This operation was, by the ancients, called embryotomy. 'The reluctance,' says Dr. Merriman, 'which every well regulated mind must feel at employing the perforator, even in cases of the greatest necessity, while the infant is yet living, naturally occasions a wish to delay the operation, till there are some indications of the child's death; and these indications are sought for in certain symptoms which most writers on midwifery have been careful to enumerate. These symptoms are, a want of fœtal motion and pulsation at the fontanels; a rolling, as of a lump or dead weight, to that side on which its mother is lying; shivering fits on the part of its mother, flaccidity of the breasts; fœtor of the uterine discharges; and an emphysematous and very loose feel of the bones of the cranium.

307. When the head, from its extraordinary bulk, is detained at the brim of the pelvis, on evacuating the contents the bones of the cranium immediately collapse, and the head is afterwards propelled by the force of the labor pains. If these are insufficient, the extraction must be made with the craniotomy forceps. The unfavorable position of the head is, of itself, a cause insufficient to justify the use of destructive instruments, which ought never to be employed but in extreme cases, after every milder method has failed. From the difficult access to the cranium, in order to make a perforation and evacuate the brain, a face case makes a very troublesome and dangerous crotchet one; very fortunately in narrow pelves the face rarely presents, and very seldom advances far in that direction, at other times the position may be so altered that the crown, the back of the ear, or some other part of the cranium, can be reached: otherwise, the crotchet must be fixed in the mouth or orbit of the eye, and the head brought along in that direction, till the perforator can be employed to open the skull

308. But the grand cause of difficult labor is the narrowness or distortion of the pelvis. For when at the brim, instead of four inches and a quarter from pubes to sacrum, it measures no more than one and a half, one and a quarter, two, or two and a quarter, the use of instruments becomes absolutely requisite; and very frequently in those of two and a half and three inches; or when the diameters through the cavity, or at the inferior aperture of the pelvis, are retrenched in the same proportion, difficulties will arise, and the delivery, except the labor be premature or the child of a small size, cannot be accomplished without the assistance of destructive instruments.

309. We judge of the form and size of the pelvis by the external make and form of the woman, by the progress of the labor, and by the touch. When the fault is at the inferior aperture the touch is pretty decisive; if a protuberance is felt in the os sacrum, instead of a concavity; if the coccyx is angulated; if the symphysis pubis projects inwards, in form of an acute angle; if the tuberosities of the ischia approach too near each other, or the one tuber be higher than the other; such appearances are infallible marks of a distorted pelvis. But, when the narrowness is confined to the brim, this is only to be discovered by the introduction of the hand within the pelvis. The projection of the lumbar vertebra over the sacrum is a species of narrow pelvis that most frequently occurs in practice. In this case the child's head, by the pressure it sustains between the pubes and sacrum, is moulded into a conical or sugar-loaf form, the parietal bones are squeezed together, overlapping one another, and will be felt to the touch, when the labor is advanced, as an acute ridge. Instead of the complicated instrumental apparatus, invented by the ancients, such as screws, hooks, &c., for fixing in, laying hold of, and extracting, the head as it presented, an operation in many cases difficult and dangerous, when the head was bulky or the pelvis narrow, as the woman frequently lost her life in the attempt; the practice of diminishing the size of the head, by opening the cranium and evacuating the brain previous to the extraction, is a modern improvement, and an important one; the instruments for this purpose consisting of the perforator, a blunt hook, and the craniotomy forceps.

310. When the accoucheur is under the necessity of destroying the child to preserve the mother, she must be laid in the position already advised for the application of the forceps, and the same rules recommended for the one operation will in general apply to the other. Thus in the narrowest pelvis that occurs, previous to opening the cranium, the soft parts should be completely dilated, and the head of the child fixed steadily in the pelvis and advanced as far as possible; for, while the head is high and loose above the brim, the application of instruments is very difficult as well as hazardous.

311. The perforatór must be cautiously introduced into the vagina, directed by the hand of the accoucheur; its points must be carefully guarded till they press against the cranium of the child, which they must be made to perforate

with a bowing kind of motion, till they are pushed on as far as the rests; they must then be opened fully, carefully reshut, half turned, and again widely opened, so as to make a sufficient aperture in the cranium.

312. They must afterwards be pushed beyond the rests, opened diagonally again and again in such a manner as to tear and break to pieces the bones of the cranium; they must then be shut with great care, and withdrawn along the hand in the same cautious manner as they were introduced, lest they should bruise or tear the uterus, vagina, or any other part of the woman. The teguments of the scalp should now be brought over the ragged bones of the cranium, and the woman should be allowed to rest an hour or two, according to her strength and other circumstances; the bones of the cranium will now collapse, and if the woman has much strength remaining, or the pelvis be not much distorted, the head, being thus diminished, will be protruded by the force of natural pains, otherwise it must be extracted by the craniotomy forceps introduced in the same manner, and guarding the point on the opposite side while making the extraction.

Class II. Order 3.

Impracticable labor, or that in which the child, even when as much as possible reduced in size, cannot pass through the pelvis, and where the Cæsarian operation becomes necessary.

Of the Cæsarian Operation.

313. This operation consists in making an incision through the abdominal and uterine parietes, sufficiently large to allow the introduction of the hand, and the extraction of the fœtus and its appendages. We know of only one instance in this country, where the preservation of the mother's life has attended its performance, while on the continent, according to M. Baudeloque, it has been abundantly successful. In England this measure is never contemplated till every other remedy has been tried; and one reason of its little success may perhaps be found in the exhaustion which these previous means may have induced. Of twenty-two cases operated on in these islands, twenty-one of the mothers died; of the children ten were born dead; and of the twelve extracted alive, four survived only a few days. The whole number of lives preserved therefore does not exceed nine.

314. The most astonishing case is that of Alice O'Neil, an Irishwoman, operated on by Mary Donally, a bold but ignorant midwife; she made an incision through the abdomen and uterus, with a razor, and held the lips of the womb together with the hand, till some one went a mile, and returned with silk and the common needles which tailors use. With these she joined the lips in the manner of the stitch employed ordinarily for the hare lip, and dressed the wound with white of eggs. The woman recovered in twenty-seven days, and the case is authenticated by Mr. Duncan Stewart, surgeon in Dungannon, and Dr. Gabriel King of Armagh.

315. The cases are very rare indeed which demand this operation; as, when the perforator has been fully employed, children have been delivered, although the distance between the ossa pubis and os sacrum did not exceed one inch and a half, and not more than two inches from one side to the other. There can be no doubt of the propriety of the Cæsarian section, where women near the full time of pregnancy die undelivered, since by this measure the child may be preserved.

316. The danger and the sacrifice of life which invariably attended the use of the perforator, and which frequently followed the Cæsarian operation, induced many enquiries for a plan of treatment which, while it might hold out a fair expectation of safety to the child, should not compromise the welfare of the mother.

317. The section of the symphysis pubis, abstinence on the part of the mother, and the bringing on of premature labor, have been tried for this purpose. Of the first we need only say that it has sunk into complete desuetude, the success attending it not being at all commensurate with the danger incurred.

318. Of the second, proposed by Mr. James Lucas, surgeon to the infirmary at Leeds, in the Memoirs of the Medical Society of London, Signior Assalini relates a case in which it was usefully enjoined; but remarks that no great reliance is to be placed upon it, for women who constantly reject, by vomiting, every particle of food they swallow, have, notwithstanding, on many occasions, large children.

319. Of the third, we believe, most practitioners think highly; and, although it cannot be denied that the mother incurs some degree of danger, it may be affirmed that she is placed in as much, if not more danger, by the use of the perforator.

320. Smellie mentions the case of a woman whose pelvis measured less than two inches and a half of conjugate diameter; she had been five times delivered, and only one child was saved, by being born in the eighth month of a very small size. He has likewise given two plates, showing a pelvis of two inches and a quarter conjugate diameter. One of these demonstrates the impossibility of a full grown fœtus, though the bones of the head are very much compressed, passing immutilated; the other exhibits a seven months fœtus clearing the strait.

321. Dr. Merriman says, that he has been made accurately acquainted with the particulars of thirty-three cases of labor prematurely induced, in the eighth month of pregnancy, on account of extreme distortion of the pelvis. In twenty-one of these the children were born dead; in four, one of which was a case of twins, they were born alive, but incapable of living more than a few hours; nine were born alive, and capable of being reared. Thus nearly one-third of the children were saved, who must have lost their lives had the women gone to their full times, and been delivered by the perforator; and all the women recovered, the majority of whom, if not the whole number, must have been lost, had the Cæsarian section been performed. There are two ways in which premature parturition may be induced, either by the careful puncturing of the membranes within the os

uteri, by the stilette of a catheter or by introducing the finger within the os uteri, to detach the decidua, thus exciting parturient action, by which the membranes may be forced upon, and will dilate the os and cervix uteri, as in natural labor. The management of the subsequent delivery, which generally occurs in from twenty-four to seventy-two hours, will of course depend on its ordinary or preternatural character.

Class III.—Labors of a complex or anomalous character.

Order 1. Labor complicated with uterine hæmorrhage, including those labors where the placenta fully, or only partially presents.

322. Having already treated of those hæmorrhages which occur before and after the birth of the placenta, we shall now briefly advert to the losses of blood we so often witness in abortion; and to those which occur in more advanced pregnancy, or at the full term of utero-gestation. Denman says, that all expulsions of the fœtus before the termination of the sixth month of pregnancy, may be called abortions; but that all expulsions in the last three months are to be considered as labors premature or regular. The practical reason for this distinction, he conceives to be of great importance: before the termination of the sixth month, these cases, generally speaking, neither require nor allow of manual assistance; but in the last three months, they admit of manual interference, if it be required, though not with equal ease; for the longer the time which is wanting to complete the period of utero-gestation, the greater will be the difficulties attending any operation it may be thought necessary to perform. In this rule we do not fully concur, as there are abortions, during the first four months, where hæmorrhage occurs to so great an extent, as would not only endanger but destroy life, were not the ovum removed by artificial help, generally perhaps, by the aid of the fingers. We were lately called to a poor woman in the third month of pregnancy (and the preparation of the ovum is now in the museum of St. Thomas's Hospital), who nearly died from hæmorrhage occurring at this period. On entering the room we were struck with the ghastly and dying appearance of the patient, whose early pregnancy had deterred the medical attendant from making any attempt to bring away the ovum.

323. The hæmorrhage was very excessive and the collapse alarming; of course nothing could be attempted as to the removal of the embryo, in this powerless state of system; and, having poured some nearly pure brandy down the throat, after an interval of about ten minutes vitality was partially restored, but with its restoration there was also a renewal of the flooding. We now introduced two or three fingers of the left hand into the vagina, insinuating them a little distance within the os uteri; here we found the ovum partly adherent and partly detached; with some slight difficulty we entirely separated it from the internal surface of the uterus, and its extraction was easily effected. The flooding immediately ceased, although the recovery was painfully protracted. The exceptions to this rule of Denman's are not unfrequent. Mr. Randall, of Finsbury Circus, lately met with a case of four months' pregnancy, where the placenta was partially adherent to the os uteri, in which the patient would have been lost had not the fœtus been manually extracted.

324. Abortion is a subject entitled to the fullest consideration of medical men, as it is a complaint of common occurrence during pregnancy, and frequently productive of serious injury to the female constitution. It is not invariably happening in weakly and debilitated women, as might naturally be expected; for consumptive patients seldom abort, and it is scarcely possible to point out a more feeble and irritable state. We may remark that weakness, or irritability in general, is seldom a cause of abortion, but some weakness or imperfection originating in or affecting the uterus and its appendages; or a peculiar kind of irritability thence proceeding, distinguishable enough in the female character, by a careful observer, which creates impatience of mind and restlessness of body, in which every occurrence is the source of ungrounded fear and solicitude, and every office is performed with hurry and vexation.

325. Abortions are not very often dangerous in the first five months; but a frequent habit of miscarriage debilitates the system, shatters the constitution, and lays the foundation of chronic diseases of the most obstinate and dangerous nature. In the advanced months the prognosis will be more or less favorable, according to the patient's former state of health; the occasional cause and symptoms with which it is attended. The proximate cause of abortion is the same with that of true labor, viz. a contracting effort of the uterus and abdominal muscles, assisted by the other expulsive powers. The remote causes cannot be explained with precision, as many circumstances, with regard to the nature of impregnation and connexion of the fœtus with the placenta and uterus, are subjects still involved in darkness. They may in general, however, be reduced to whatever interrupts the regular circulation between the uterus and placenta: every cause that excites the spasmodic contraction of the uterus, or other assisting powers; whatever occasions the extinction of life in the fœtus. Amongst the first are, diseases of the uterus; imperviousness or spasmodic constriction of the extremities of the uterine blood-vessels; partial or total separation of the placenta or chorion from the uterus; determination to other parts.

326. To the second general head belong all causes that produce a strong contraction of the elastic fibres of the uterus or of the parts that can press upon it; or that occasion a rupture of the membranes, such as violent agitation of the mind or body; a disease of the membranes; too large a quantity of the liquor amnii; the cross position of the fœtus; its motion and kicking.

327. The third and last head includes the numerous causes of the death of the child, which, besides those referred to in the preceding classes, may be occasioned by diseases peculiar to itself: diseases communicated by the parents; external accidents happening to the mother, or accidents incident to the fœtus in utero; diseases of the placenta or funis; knots and circumvolutions of the chord; too weak an adhesion of the placenta or chorion to the uterus; and every force that tends to weaken or destroy this attachment.

328. As to the treatment, it must be varied according to the particular circumstances of the case; nor is it possible to point out particular indications, or propose any regular plan to be pursued for this purpose. Abortion is often preceded by no apparent symptoms, till the rupture of the membranes and evacuation of the waters announce the approaching expulsion of the fœtus. Either to remove threatening symptoms, or to prevent miscarriage when there is reason to apprehend it, often baffles our utmost skill; because it generally happens that there is a cessation of growth in the ovum, or in other words an extinction of life in the fœtus, some time previously to any appearance of abortion. For instance, in early gestation a woman often miscarries about the eleventh or twelfth week, but the age of the fœtus at this time is generally no more than eight weeks. At other times, when by accident the fœtus perishes, perhaps about the fifth or sixth month, it will still be retained in utero, and the expulsion will not happen till near the completion of the full time.

329. As women who have once miscarried are liable to a recurrence from a like cause, at the same particular period; such an accident in future pregnancies should be guarded against with the utmost caution. On the first appearance of threatening symptoms the patient should be confined to a horizontal posture; her diet should be light and cooling; her mind should be kept as tranquil as possible; a little blood from the arm may be taken occasionally, and opiates administered according to circumstances; but excepting so far as depends on these, and such like precautions, in the way of medicines very little can be done. The medical treatment of abortion must therefore be considered with a view only to the prophylactic cure, and this will consist chiefly in a proper regimen.

330. *Of the proper regimen during pregnancy.*—Women when pregnant should live a regular temperate life; moderation in eating and drinking should be carefully observed, and every thing having a tendency to disagree with the stomach should be avoided; in other respects the manner of life should be much as usual. If complaints occur they should be treated as at other times, only guarding against such things as, by violent operation, may endanger miscarriages. If the patient has formerly been liable to this accident, the cause should be carefully considered and suitable remedies applied; if plethoric, for instance, a little blood may be advantageously abstracted, she may live abstemiously, and preserve the utmost tranquillity till she gets beyond the dangerous period. If she be weak, delicate, and nervous, bark, light aromatic bitters, mineral waters, and the cold bath (if able to bear it) will be the best remedies. The cold bath has in many cases cured the most obstinate fluor albus, and sometimes even sterility itself, and in relaxed habits, disposed to miscarriage, when every other means has failed it has done considerable service; the practice may safely be continued for several months after conception, when it has been early begun or the patient has been accustomed to it. Such a shock will, however, have very different effects on different constitutions, and on persons not accustomed to the cold bath; hence it is an expedient by no means to be indiscriminately used in the pregnant state.

331. Abortions that happen in early gestation, and that come on suddenly, without any presaging sign, can only be prevented by avoiding all occasional causes, by counteracting morbific dispositions, and by confinement to a horizontal posture for some time before and after the critical period is over. When a venereal taint in the parents is suspected to be the cause, either of abortion or the death of the fœtus, the like accident can only be prevented by putting both parties on a mercurial course.

332. Pregnant women require a free pure air; their amusements should be often varied; their companions should be agreeable and cheerful; their exercise should be moderate, and suited to their inclination, constitution, and the season; they should avoid crowds, confinement, and travelling over rough roads in a carriage. Women should with the utmost care guard against confining the breasts or abdomen; and they should keep themselves as loose and easy as possible through the whole term of gestation. When the abdomen is pendulous, towards the latter months, a gentle support by a proper bandage will prove useful; and the woman, when fatigued, should occasionally through the day indulge in resting on a bed or sofa.

333. *Of the floodings occurring nearly at the full term of utero-gestation, and at the commencement of labor.*—There is, perhaps, no circumstance attendant on parturition which excites such solicitude in the accoucheur, or exposes the patient to such imminent danger, as repeated or large losses of blood at the termination of pregnancy, or in the commencement of labor. We can readily conceive how uncertain and inefficient the treatment of such floodings must have been, prior to the appearance of Dr. Rigby's most excellent and invaluable work, who tells us that most of the authors whom he had read on this subject describe these cases as peculiarly embarrassing, acknowledging that they have always been at a loss, when such have occurred to them, to determine with any degree of certainty and satisfaction which of the two methods of practice hitherto recommended it has been most proper to adopt, whether to endeavour to restrain the discharge by the means before mentioned for that purpose, and leave nature by her own efforts to expel the child, as is the case in floodings of the early months; or at once to introduce the hand into the uterus and bring it away by art. This doubt about the propriety of waiting, or the necessity of removing the contents of the womb, they say, is ever owing to the uncertainty of knowing the quantity of blood that has been lost; and, if it were known, to the impossibility of ascertaining the degree of loss a woman might sustain without manifest risk of life. These statements Dr. Rigby proved to be incorrect, observing that a knowledge of the true causes that produce floodings will give us all the information, which may be considered as the first requisite towards an improvement in the practice; for these floodings arise from two very different causes

which are very different in the danger they produce, and which require a very opposite method of treatment. The separation of the placenta from the uterus before the delivery of the child, and the consequent opening of its vessels, must be looked upon as the proximate cause of every considerable discharge of blood from the womb at that time; but this premature separation may be produced by very different causes. These causes it is necessary to understand, that we may see the reason why the same apparent complaint should very often so widely differ in its termination and treatment.

334. There is no particular part of the uterus to which nature seems constantly and uniformly to fix the placenta; it is nevertheless for the most part so situated, that if the woman be healthy, and no accident befal her, it does not separate until the full term of pregnancy, nor then before the entire expulsion of the child; after which it becomes disengaged from the uterus, and is thrown off, making room for its entire contraction, which shutting up the mouths of the vessels effectually prevents any considerable loss of blood; for which purpose it is plain it must be fixed to some part of the womb which does not dilate during labor, namely, to the fundus or side of it. In this case, then, when a flooding comes on before the delivery of the child, it is obvious that the separation of the placenta must be owing to some accidental circumstance, to violence done to the uterus by blows or falls, to some peculiar laxity of the uterine vessels from the badness of habit, or fever, or to some influence of the passions of the mind, suddenly excited, such as fear, anger, &c.

335. But, from the uncertainty with which nature fixes the placenta to the uterus, it may happen to be so situated, that when the full term of pregnancy is arrived, and labor begins, a flooding necessarily accompanies it, and without the intervention of any of the above accidental circumstances; that is, when it is fixed to that part of the womb which always dilates as labor advances, namely, the collum and os uteri; in which case it is very certain that the placenta cannot, as before described, remain secure till the expulsion of the child, but must of necessity be separated from it, in proportion as the uterus opens; and by that means a hæmorrhage must unavoidably be produced.

336. That floodings which arise from these two different causes, which may be distinguished by the names of accidental and unavoidable, though they may appear exactly similar in their first symptoms, should terminate very differently if left to nature, assisted only by the palliating means before mentioned, cannot seem strange; nor can it be a doubt that, of these two kinds of floodings, only one of them, namely, that which is produced by an accidental separation of the placenta, can be relieved by the use of these palliatives; and that the other, in which the placenta is fixed to the os uteri, and the flooding is therefore unavoidable, cannot possibly be suppressed by any other method whatever than the timely removal of the contents of the womb; for, supposing the discharge to be for a while restrained, by bleeding, medicine, cool air, &c., it will inevitably return when nature is so far recovered as again to bring on labor; in the first case, if hæmorrhage have been checked by the use of the above means, it is not impossible but labor may come on, and the child be safely expelled by the natural pains before it returns; or, if it should return, it may not increase in quantity, as, in this case, very probably the separated part of the placenta which occasions the discharge remains nearly the same; whereas, in the other case, in which the dilatation of the os uteri produces the separation of the placenta, every return of pain must be a return of the bleeding, and it must become greater and greater as the uterus opens more and more; and the placenta is in proportion detached, till it increases to a degree that exhausts the patient, and she dies before nature has been able to expel the child. That such must inevitably be the progress and event of floodings, arising from such a cause, if left to nature, is too obvious to be further insisted on.

337. Admitting then that floodings are produced by these two different causes, and that they require a treatment so widely different, we cannot be at a loss, says Dr. Rigby, when such do occur to us and we have discovered the particular cause from which they arise, how to act; as in the one case we shall be encouraged to wait, and to make use of such means to restrain the discharge as will be more particularly mentioned hereafter; and in the other we shall not hesitate to have recourse to delivery by turning the child. Dr. Rigby has not only fully proved the necessity of turning the child, whenever the placenta is fully attached over the os uteri, but he has also established the value of the practice of rupturing the membranes, when flooding appears before delivery, and the placenta is not to be felt. Of sixty-four cases of accidental hæmorrhage, treated in this way, every patient was saved, although some had lost a large quantity of blood, and were very faint, previously to the operation being performed. In many indeed the flooding was trifling; but even in these sufficient to excite some degree of alarm.

All practitioners are now fully agreed that, whenever the placenta wholly presents, the best chance of saving the patient is by delivering at the most suitable opportunity; and that in accidental hæmorrhage the most successful practice is to rupture the membranes, and leave the case to be perfected by the natural powers; provided the flooding cease on the evacuation of the liquor amnii. There is still, however, a diversity of opinion as to the course to be pursued where the placenta is only partially adherent to the os uteri, in which some accoucheurs invariably resort to artificial delivery; while others, and amongst them Dr. Francis Ramsbotham, pursue a different plan. If not more than one-third of the os uteri is occupied by placentar attachment, an attempt is to be made to relieve the patient by evacuating the waters, and allowing time for the uterus to act, carefully watching the patient lest the draining be kept up after the membranes have been ruptured. Dr. R. urges, in support of this practice, the great fatality which has attended placenta, and partial pla-

centa presentations, generally in his practice, when treated by turning; and the great danger of suddenly evacuating the uterus at any time, and especially under the state of faintness produced by loss of blood. After the evacuation of the waters, besides the blood-vessels of the uterus being very much diminished in their calibre, and allowing less blood to circulate through them, if uterine action come on, the head will, in passing through the os uteri, close by its pressure the mouths of the bleeding vessels, and in this manner suspend the hæmorrhage; and, should the contractions continue, the child is ultimately expelled. Provided, however, the uterus does not act sufficiently strongly to restrain the hæmorrhage, and expel the fœtus, it will be more or less flaccid, and there will be but little or no impediment to the passage of the hand into the uterus, and the delivery by the feet; the only resistance being the contracted uterus, when contraction has not taken place there can be no difficulty; the case is perhaps more likely to terminate favorably when turning is had recourse to after the water has been evacuated some time, and the uterus has slightly embraced the body of the child, than when a more hasty delivery is effected; because in that case the uterus is to a certain degree lessened in volume, there is not so sudden a diminution of bulk, and the dreaded collapse is not so likely to occur. Dr. R. has seen many cases in which this plan has been adopted, when the patient's existence was depressed to its lowest ebb, and where it has been attended with the happiest results. At the same time he presses on the recollection, that, should hæmorrhage continue after the perforation of the membranes, so as to endanger the patient's life, there is but one mode to be adopted, that of as speedy a delivery as possible.

Order 2. Labor complicated with convulsions.

338. Cases of puerperal convulsion bear a strong analogy to epileptic fits; so much so that it is nearly impossible to distinguish them at first sight, excepting from the different degree of violence attending each; the fit of puerperal convulsions being much more violent than any fit of epilepsy. Indeed, the paroxysm is so violent that a woman, who, when in health, was by no means strong, has shaken the room with her exertions.

339. Puerperal convulsions may arise at any period between the sixth month and the completion of labor; rarely or never do they occur before the sixth month. They may arise as the first symptom of labor—in the course of labor—or after the labor is in other respects finished. Puerperal convulsions always occur in paroxysms, and those paroxysms occur periodically, like labor-pains: so that there is a considerable time, perhaps two hours, between the two first attacks: after this they become more frequent. They not only occur with the labor-pains, but in the intervals; and, whether there have been labor-pains or not before they come on, we shall always find the os uteri dilated, and it is sure to become dilated from the continuance of these convulsions; and at length, if the woman be not relieved, and the convulsions continue without destroying her life, the child is actually expelled without an labor-pains. In severe cases, where death has occurred previous to the birth of the child, it has been found partly expelled by the contraction of the uterus; which power had been exerted even after the death of the mother. In one case the whole child was expelled except the head.

340. It is a disease depending on the uterus, and brought on by labor-pains; or, if arising before them, is of itself capable of expelling the child, if the woman survive long enough. It occurs in all presentations; sometimes with the first child, and sometimes with those born afterwards. It resembles hysteria, as well as epilepsy; but is more violent than either. No force can restrain a woman when in these convulsions, be the same woman naturally ever so weak. The distortion of the countenance, also, is beyond any thing that can be conceived; in regard to deformity, surpassing any thing the imagination of the most extravagant painter ever furnished: nothing bears any resemblance to the progress of this disease; the rapidity with which the eyes open and shut, the sudden whirlings of the mouth, are altogether inconceivable.

341. These convulsions are by no means external only; respiration is affected with a hissing and catching. The patient stretches herself out, and immediately the convulsion begins. The next symptom appears after the convulsive motions have continued with their utmost violence for some time: the woman foams at the mouth, and snores like an apoplectic patient, indicating great fulness of the cerebral vessels. These symptoms are succeeded by a comatose sleep, from which she awakes astonished, when told what has happened, not being aware that she has been in any fit: and then she will fall into another fit, out of which she will again recover as before. It rarely happens that the understanding is taken away in this disease, until it has been repeated several times. In the fit, the skin becomes dark and purple, proving that the circulation through the lungs is not free: this gradually disappears after the subsidence of the fit. The uterus, as well as the respiratory muscles, is affected: this may be known by introducing the hand when the convulsions come on; the uterus will contract, but with a tremulous indecisive force, perfectly different from its usual contraction.

342. There are two cases of puerperal convulsions which are very distinct: one is a convulsion dependent on some organic affection of the brain; the other on an irritable state of the nervous system. Where puerperal convulsion arises from the former, but more especially from fulness of vessels or extravasation, it is always preceded by some symptoms, which, if watched, will enable us to relieve the patient, provided that we are very quickly summoned.

343. In a patient strongly disposed to this disease there will be a sense of great fulness in the region of the brain, which amounts even to pressure; giddiness in the latter periods of pregnancy; and a sensation of weight when the head stoops forward, which gives her the idea that she will be unable to raise it again; imperfect vision; and dark or luminous bodies will be dancing

before the eyes. This state of the eyes denotes fulness of the vessels of the head more surely than any other symptom; and, if allowed to continue, will lead to extravasation and puerperal convulsions. The disturbed vision is a very important symptom, and must never be passed by. If attended to early, even though symptoms of the complaint are present, still it may, by timely assiduity on our part, be prevented from ending in premature labor. Here repeated bleedings and purgatives are all in all; the sole object being to remove stimuli. After bleeding, and before any aperient is given by the mouth, we should inject, per anum, a solution of soft soap in warm water; it is the quickest and the surest means; after this administer a purgative mixture, containing Epsom salts and manna. By these means, that is, by bleeding, purging, and abstinence from all solid food and wine, the quantity of circulating fluid in her body is diminished, and she gradually recovers.

344. When convulsions arise from a generally irritable state of the nerves, it is difficult to distinguish the disease before it becomes established. It is most frequent in large towns, and in women who lead an indolent life; hence it is most frequently found in the first circles of fashion: and there is one grand circumstance which has great influence in its production—viz. a woman's being pregnant when she should not. Obliged perhaps to live secluded from society for some months, she reflects and broods over every thing which relates to her situation, and which gives her pain; she recollects that she is not to enjoy the society of her babe, but, on the contrary, will be obliged perhaps to part with it for ever: she is afraid of her situation being known, and that she will be considered an outcast from society. In this way will she brood in solitude, till at last the mere irritation of labor will be sufficient to induce convulsions. The difference between this kind of puerperal convulsions and the other, does not probably consist in any thing visible; it is not possible to tell the difference exactly; but, just as it is coming on, the woman will complain of a violent pain in her head or stomach, which is expressed in the same terms by all women; they all say that they cannot survive a return of the pain. The mode of treatment will not essentially vary from that already mentioned: our plan should however be less active; and opiates should succeed the primary measures.

345. These observations, be it remembered, relate to convulsions antecedently to labor. We now proceed to the same disease during labor. It has sometimes happened that a woman has died of the first convulsion: but it more generally happens that a number come on in succession, arising either after or before delivery. The patient very rarely dies in the fit, though she dies from the convulsions: she dies in the comatose stage which succeeds the convulsion; and if we be suddenly called to a patient in this state, where we are unable to learn the circumstances of the case, and we evidently see that there is great fulness about the head, we should immediately open a vein, and draw blood largely, being regulated by the appearance of the patient, and by what we can learn from the by-standers. From twelve to twenty ounces may be the extent of the first bleeding; if the disease continue, and the os uteri be not at all dilated, the convulsions not subsiding, and the pulse in such a state as to warrant the measure, we should bleed again and again. Some practitioners have with the greatest advantage taken sixty ounces of blood in a day. A woman in this state will bear very large divided bleedings. This takes off the pressure of the distended blood-vessels from the brain, and presents the chance of extravasation. This being promptly effected, the head must be shaved, and a large blister applied over the whole cranium. The next means of relief is to get the bowels into action as quickly as possible; first, by throwing up a solution of soft soap, and then by giving her to drink a solution of some neutral salt in infusion of senna.

346. If it be a case of convulsions depending upon irritation, we may certainly do something more by the use of opiates; and in this case we must be more cautious in abstracting blood. The proportion of blood removed must be small in this case, compared with that in plethora. Eight or ten ounces will be a full bleeding; and, if it be necessary to take more, we may apply leeches to the temples, never neglecting to keep the bowels freely opened. It has been directed that the patient be placed in a warm bath, but experience contradicts its use: the fits have been found to be more violent in it, and the patient is liable to bruise herself, or be otherwise much injured.

347. It is an extremely dangerous disease; her brain cannot bear the excessive pressure of her situation; opium therefore, in cases of irritation, is proper, and should be given to the greatest possible extent. With this we may join the affusion of cold water. This, when resolved on, must not be done by sprinkling a little on the patient's face; but we must have both a full and an empty pail, the patient's head being brought over the side of the bed, and, before the fit comes on, we may, as in other convulsions, detect its approach by observing the intercostal muscles, the violent action of which will warn us that no time must be lost; when we should immediately dash the pail-full over the head. Whenever this complaint appears at or near the time of labor, it is uniformly proper to deliver: to dilate the os uteri, and deliver immediately. This is the only cure for puerperal convulsions.

348. If convulsions occur some days after labor, it should be treated as in other cases of the same disease.

Order 3. Labors complicated with rupture of the uterus, vagina, perinæum, &c.

349. These cases are very rarely occurring in well managed parturition, and they will require only a brief notice. Dr. Denman attributes one occurrence of lacerated perinæum, in his own practice, to extreme restlessness and irritability of the patient, preventing the necessary precautions from being used. He further says that the frequent occurrence of this laceration in the human species, allowing that it is in some cases

and in some degree unavoidable, ought to be imputed to some accidental cause, or to error in conduct, rather than to any peculiarity in the construction of the part, or in the circumstances of their parturition; because, when women were delivered without assistance, he has not in any case observed any very considerable laceration. We believe that the power necessary to be exerted in parturition is, excepting in some rare instances, nicely proportioned to the degree of resistance which it has to overcome, and we of course concur in the opinion expressed by Dr. Denman in the preceding lines. Laceration of the perinæum is most frequently occurring from the premature and sudden propulsion of the head through the external parts, previously to their complete dilatation, when the perinæum is thick and rigid. We may add to this cause the voluntary force, or bearing down the pains, so common at the time of parturition, in the performance of which women exert a considerable degree of voluntary power, often indeed their whole strength, with the hope and intention of finishing their labors speedily. This accident therefore rarely happens in very slow or difficult labors, whatever may be the size or position of the head of the child.

350. It is generally recommended, when supporting the perinæum, to interpose a soft napkin between it and the hand; from this injunction we dissent, as it is manifest if the napkin be three or four times doubled, and it cannot very well be less if it afford any soft cushiony support to the part, the accoucheur must be in ignorance as to the precise condition of the perinæum, it may or it may not be in a fit condition to allow the passage of the head: laceration almost invariably occurs, not because the head is too large, or from its passing in any particular direction, but because it passes too speedily or presses, as we have before remarked, too violently or suddenly, upon the undilated parts: of all these circumstances, the naked palm of the hand will enable us to judge much more correctly than if a napkin be interposed. We have seen one case of laceration arising from this want of correct information, the head passed down to the outlet suddenly, the attendant immediately supported the perinæum by a soft napkin; the perinæum was lacerated, and the child immediately thrust into the world.

351. The cure of a lacerated perinæum is very tedious; and, although no danger arises from the accident, yet if it divide the partition or septum between the vagina and rectum, the patient is rendered truly miserable; for, having little or no power of retaining her fœces, she cannot go into society.

352. Sutures have been advised in the treatment of lacerated perinæum, it being supposed that the parts might be retained in opposition sufficiently long to establish firm union between them: they have not been attended with success, as the ligatures have sloughed away, and the patient has been left in a worse condition than before. We have seen two instances of lacerated perinæum, and in one, where the rectum and vagina ,communicated, we induced tolerably firm union in six months; quite enough to enable the lady to retain her fœces, and to perform her usual duties. This lady maintained the recumbent position with the thighs closed during nearly the whole of this time; the wound was occasionally touched with the argenti nitras and the nitric acid lotion. Eighteen months after the occurrence of the accident she was again confined; and, although there was a good deal of relaxation about the parts, they did not separate: since this period no inconvenience worth mentioning has been experienced.

353. *Laceration, or rupture of the uterus.*—Dr. Merriman says that this accident has happened from a morbid state of the uterus, before the period of utero-gestation has been completed, and the fœtus, having escaped into the cavity of the abdomen, forms what is called an extra-uterine conception of the ventral kind. Sometimes the laceration of the uterus appears to have been produced by the untoward situation of the uterus in the pelvis; hence ulceration has taken place, and the fœtus has been transferred into the cavity of the pelvis, and finally discharged through the vagina or rectum in a dissolved, or putrid state.

354. But more commonly the rupture is occasioned during labor from the violence of the pains acting irregularly, or impetuously, against some projecting part of the child; upon which the uterus splits: and this is more likely to happen in cases of distorted pelvis, or of preternatural presentation of the child. Or it may be occasioned by the rude and forcible attempts of the operator to turn the child in utero; or by inconsiderate and violent endeavours to introduce instruments; and sometimes the immense bulk of an emphysematous child, in passing through the os uteri and vagina, has torn these parts asunder.

355. If the rupture of the uterus has taken place before the full term of gestation is accomplished, and while the os uteri is undilated, it is obviously impossible to afford the patient any kind of manual assistance; the case must therefore be trusted to nature, and, under such circumstances, some women have wonderfully recovered; the child, in a dissolved state, having, in a few instances, after months or years, made its way through the parieties of the abdomen by the process of ulceration. The operation of gastrotomy has been recommended, to give nature an earlier opportunity of getting rid of the burden, but the success of such an operation is doubtful.

356. When a laceration happens during the pains of labor, the following symptoms usually occur:—

1. A sense of something giving way internally preceded by a very severe pain, generally described as a cramp.

2. A sensation of great languor and debility.

3. A speedy, sometimes an instantaneous, vomiting of the contents of the stomach.

4. A vomiting of a brownish, or coffee-colored, fluid.

5. A very quick, weak, fluttering, pulse: a cold sweat; great difficulty of breathing; an immediate cessation of the labor-pains.

357. If now the patient is examined, per vagi-

num, it will generally be found that the presenting part of the child, which had before been pressed some way into the pelvis, is retracted, and no longer within reach of the finger; and if the hand be carried through the os externum, in order to make a more accurate examination, the child will be discovered to have passed, either wholly or in part, through a rent, into the cavity of the abdomen. There are, however, a few instances in which the child has remained in utero, notwithstanding the laceration.

358. The mode of practice recommended by many authors, in these unfortunate cases, is to give the patient a chance of recovery by introducing the hand through the rent till it reaches the feet of the child, wheresoever they are to be found, and extracting the child footling. In a few instances this plan has succeeded in saving the patient's life, but more commonly all that is done proves unavailing, and death speedily ensues.

359. The practice here recommended was countenanced by Dr. Denman in his Introduction to Midwifery; but circumstances have, since that time, induced him to reconsider this case more particularly; and, after much enquiry and reflection, he seems to be convinced that, upon many occasions, the patient would have a better chance of recovery, if the case were resigned to the natural efforts, than by any operation or interposition of art. Either of these plans must be preferred according to circumstances. If, in a case of this kind, it should be found that the child had only in part escaped into the cavity of the abdomen, we should consider that it was the best practice to bring down the feet, if they were within reach, or to deliver by means of the forceps, if the situation of the head allowed of the application of this instrument. And even if the child had been wholly forced through the rent, that it would be expedient to extract it by the feet, provided there was a ready passage for the hand into the cavity of the abdomen, and the accident had not been of long duration; but if some hours had elapsed after the parts had given way, or if there were a difficulty in passing the hand, on account of the contraction of the uterus, it would then perhaps be more prudent to leave the event to nature.

We have now concluded the three principal divisions of our subject; and the circumstances, and some of the diseases, immediately succeeding parturition alone remain to be noticed: we shall first allude to

The Treatment after Delivery.

360. Immediately after the placenta is expelled, the finger ought to be introduced into the vagina, to ascertain that the perinæum, or recto-vaginal septum, be not torn, and that the uterus be not inverted. Then, if the woman be not much fatigued, or if she be prone to hæmorrhage, Mr. Gaitskell's belt, supposing it to have been previously applied, may be gently tightened. We are not greatly inclined to the practice of turning the patient on her back and submitting her to the process of fastening round the abdomen a broad bandage, intended to give a feeling of agreeable support. We believe, in the majority of instances, if the placenta has been slowly extracted, and if the uterus be afterwards slightly grasped by the hand, firm and permanent contraction will be induced: at least we have not unfrequently known partial hæmorrhage to arise from the disturbance of circulation produced by this putting on of the bandage. Circumstances must, however, in all these cases, regulate our procedure; and, if any additional comfort or security can arise to the patient from this application of the abdominal roller, it certainly ought not to be neglected. The wet sheet is also to be pulled from below her (vide Burns's Midwifery, p. 387), and an open flannel petticoat to be put on; it has a broad top band, and is introduced and pinned like the bandage. A warm napkin is then to be applied to the vulva, and the woman raised in an easy posture, having just so many bed-clothes as make her comfortable. If she desire it, she may now have a little panada, after which we leave her to rest. But, before retiring, it is proper to ascertain that the bandage be left sufficiently tight, that there be no considerable hæmorrhage, and that the after pains are not coming on severely. It is also proper to mark the state of the pulse, and to leave strict directions with the nurse that every exertion and all stimulants be avoided.

361. Having thus simply stated what appears to be necessary, I must next say what ought to avoided. It is customary with many nurses to shift the patient completely; and, for this purpose, to raise her to an erect posture. Now this practice may not always be followed by bad consequences, but it is very reprehensible; for the patient is thus much fatigued, and if she sit up, even for a short time, hæmorrhage or syncope may be produced. The pretext for this is generally to make the patient comfortable; and, indeed, if the clothes be wet with perspiration or discharge, there may be some inducement to shift her. But this ought to be done slowly, without raising her, and, if she have been fatigued, not until she has rested a little. Another bad practice is the administration of stimulants, such as brandy, wine, or cordial waters. I do not deny that these, in certain cases of exhaustion, are salutary; but I certainly maintain that generally they are both unnecessary and hurtful, tending to prevent sleep, to promote hæmorrhage, and excite fever and inflammation. A third practice, no less injurious, is keeping the room warm with a fire, drawing the bed-curtains close, increasing the bed-clothes, and giving every thing warm to promote perspiration. This is apt to produce debility, and many hysterical affections, as well as a troublesome species of fever, which it is often difficult to remove. It also renders the woman very susceptible of cold—a shivering fit is very readily excited. Lastly, talking, and noise of every kind, is hurtful, by preventing rest, occasioning head-ache or palpitation, as well as other bad symptoms.

362. At our next visit, which ought to be within twelve hours after delivery, we should enquire whether the patient have slept, and ascertain that the pulse be not frequent; that the after pains have not been severe; nor the discharge copious. We should also particularly enquire if she have made water; and if she have not, by

have a desire to do so without the power, a cloth dipped in warm water and wrung pretty dry, should be applied to the pubes. If this fail, the urine will often be voided if the uterus be gently raised a little with the finger; or the catheter may be introduced. There are two states in which we are very solicitous that the urine be voided: the first is when the woman has much pain in the lower belly, with a desire to void urine; the second is after a severe or instrumental labor.

363. A motion should be procured within twenty-four hours after delivery, either by means of a clyster or gentle laxative. If the patient usually have the milk fever smartly, or the breasts are disposed to be painful and tense, a mild dose of some saline laxative is better than a clyster. But if she be delicate, and have formerly had little milk, a clyster is to be preferred. If she is not to suckle the child, then the laxative should be rather brisker, and may be repeated at the interval of two days.

364. After delivery there is a discharge of sanguineous fluid from the uterus for some days, which then becomes greenish, and lastly pale, and decreases in quantity, disappearing altogether within a month, and often in a shorter time. This is called the lochial discharge. During this time, it is necessary that the vaginal and external parts be daily washed with tepid milk and water.

365. During the latter end of gestation, milk is generally secreted in a small quantity in the breasts, and sometimes it even runs from the nipples. After delivery the secretion increases, and about the third day the breasts will be considerably distended. Many women, indeed, complain at this time of much tension and uneasiness; and there is usually some acceleration of the pulse. A pretty smart fever may even be induced, which is called the milk fever. The best way to prevent these symptoms from becoming troublesome is to keep the bowels open, and apply the child to the breasts before they have become distended. This may generally be done twelve hours after delivery.

366. The diet of women in the puerperal state ought to be light; and, if they are not to nurse, liquids should be avoided, the food must be of the dry kind, and thirst should be quenched rather with fruit than with drink. If they are to nurse, the diet, for the first two days, should consist of tea and cold toasted bread for breakfast, beef or chicken soup for dinner, and panada for supper; toast or barley water may be given for drink, but malt liquor should be avoided. Unless the patient be feeble, and at the same time have no fever, wine should not be allowed for the first two days; a little may then be added to the panada or sago, which is taken for supper; and a small glass, diluted with water, may be taken after dinner. A bit of chicken may be given for dinner, and, in proportion as recovery goes on, the usual diet is to be returned to.

367. The time at which the patient should be allowed to rise a little, to have the bed made, must be regulated by her strength and other circumstances. It ought never to be earlier than the third day; and in a day or two longer she may be allowed to be dressed and sit a little, but even in the best recovery, and during summer, the woman ought not to leave her room within a week. She ought not to go out for an airing, in general, till the third week. In cold weather, and when the patient is delicate, she must be longer confined. By rising too soon, and making exertion, a prolapsus uteri may be occasioned, and still more frequently the lochia are rendered profuse, and the strength impaired. If there be, or have formerly been, the smallest tendency to prolapsus, it is absolutely necessary to keep the patient very much for some time in a recumbent posture on a sofa, avoiding, however, that degree of heat which relaxes the system. It is also necessary to stimulate the uterine lymphatics to absorption by a smart purgative once in three or four days, to bathe the external parts with rose water, having a third part of spirits added to it; and at the end of a fortnight begin a tonic, mixed with a mild diuretic.

368. *Of after pains.*—Few women proceed through the early part of the puerperal state without feeling attacks of pain in the belly, which are called after pains. These are generally least severe after a first labor. They proceed from the contraction of the uterus in an irregular manner, excited by the presence of coagula or other causes; and each severe pain is generally followed by the expulsion of a clot. They come on usually very soon after delivery, and last for a day or two. They are often increased when the woman first applies the child to the breast. They are distinguished from inflammation of the uterus or peritonæum, by remitting or going off. The belly is not painful to the touch, the uterine discharge is not obstructed, the patient has no shivering nor vomiting, the milk is secreted, and the pulse is seldom frequent. When the pulse is frequent, then we must always be on our guard; for, if this be the case before the accession of the milk fever, the patient is not out of danger; and, if any other bad symptoms appear, we must be prompt in our practice. After pains may also be caused by flatulence and costiveness, which we know by the usual symptoms; but a combination of this state, with uterine after pains, is often attended with a frequency of the pulse, and may give rise to a fear that inflammation is about to come on, but other symptoms are absent. Uterine after pains are relieved by opiates and fomentations; and, if protracted, by a purgative, and this is always proper when the pulse is frequent. A severe constant pain in the hypogastric region is sometimes produced by an affection of the heart, and proves fatal, yet the uterus is found healthy. Upon this subject it may not be improper to mention, that a young practitioner may mistake spasmodic affections or colic pains for puerperal inflammation; for in such cases there is often itching and sensibility of the muscles, which renders pressure painful. But there is less heat of the skin, the tongue is moist, the pulse, though it may be frequent, is soft, the feet are often cold, the pain has great remission if it do not go off completely, there is little fullness of the belly, and the patient is troubled with flatulence.

369. It requires laxatives, antispasmodics

anodyne clysters, and friction with camphorated spirits. Oil of turpentine acts both as a laxative and antispasmodic. In doses of half an ounce, it often relieves spasmodic pain in the stomach or bowels. Blood drawn in this disease, after it has continued for some hours, even when the woman is not in child-bed, is sizey; and is always so in the puerperal as well as the pregnant state, although the woman be well.

370. It is necessary to attend carefully to the duration and situation of pain after delivery, and to the symptoms connected with it. For it may proceed from inflammation of the viscera; or in some cases it is felt near the groin, and may be the forerunner of swelled legs; or about the hip, ending in a kind of rheumatic lameness; or, in consequence of the application of cold, pain may be felt in some part of the recti and oblique muscles, which, if not removed by fomentations and frictions, may end in tedious abscess, exciting hectic fever. Such an abscess ought to be opened with a lancet or caustic.

371. Rheumatism affecting the muscles of the abdomen and pelvis is accompanied by less fever than puerperal inflammation, and wants the other symptoms. The pain is shifting and acting, or gnawing, though sometimes it is sharp like a stitch. It is relieved by friction with laudanum, by sinapisms, and by mild diaphoretics, bark, and other usual means. When speaking of rheumatic pain it may not be improper to mention, that chronic rheumatism, especially of the extremities, is very troublesome when it occurs after parturition. It requires the usual remedies. Cod-liver oil, in doses of half an ounce three times a day, has been much recommended. I have formerly noticed those pains in the limbs which may succeed the use of the crotchet.

372. *Of the milk fever.*—The secretion of the milk is usually ushered in by a slight degree of fever, or, at least, a frequency of the pulse. But sometimes it is attended with a smart febrile fit, preceded by shivering, and going off with a perspiration. This attack, if properly managed, seldom continues for twenty-four hours; and, during this time, the breasts are full, hard, and painful, which circumstance distinguishes this from more dangerous fevers. Sometimes, during the hot fit, there is a slight delirium. A smart purge generally cures this disease, and is often used in plethoric habits, on the third day after delivery to prevent it. Mild diaphoretics during the hot stage are also proper. Applying the child early to the breats is a mean of prevention.

373. We have great pleasure in laying before our readers the following successful case of complete extirpation of the uterus: the propriety of so bold and difficult an operation has been much questioned, yet we feel assured that in diseases of the womb, otherwise irremediable and fatal, this measure, adopted with discrimination and executed with skill, may preserve a life which without it would certainly be sacrificed. The author of this paper is indebted to Dr. Blundell, Lecturer on Physiology and Midwifery, Guy's Hospital, for the subjoined particulars, whose ability and zeal in the diffusion and improvement of obstetric science deserves, and will obtain, higher praise than it is in his power to bestow. It is proper to observe that this is the second time Dr. Blundell has performed this operation: in the former instance the patient died.

374. Mrs. M., at fifty, the mother of two children, the younger of which is sixteen years old, with a uterus about as large as a goose's egg, and a lax vagina, was seized with leucorrhœal discharges and frequent eruptions of blood from the womb; so that for six or seven months together she was scarcely ever free from flooding more or less copious, always increased by bodily exertion and generally succeeded by syncope. Though not prone to speak hyperbolically, she states that on repeated occasions the bleeding was so excessive, that it soaked through a bed twice as thick as an ordinary sofa cushion, and formed a small pool on the floor beneath. It may be difficult to conceive whence so large a quantity of blood could be derived, yet it is her own considerate opinion that for weeks together, she must have lost from half a pint to a pint of blood daily. Her person is short and broad, her complexion apparently of the sanguine kind, and her digestive organs on the whole more powerful than we generally find them under uterine disease. Her strength being much reduced, her appearance exsanguineous, frequent faintings occurring, and no relief having been obtained under the care of three or four respectable practitioners, she was referred to Dr. Blundell, who found on examination an enlargement and induration of the os uteri and the adjacent portion of the vagina, extending perhaps through one-fourth part of its length above, about two-thirds of the mouth of the womb being already destroyed by incipient malignant ulceration. Under these circumstances, Dr. Blundell informed her that extirpation of the diseased structure, though not disproved to be dangerous in a high degree, comprehended her only remaining chance of life. After deliberating for two or three days, and from the occurrence of another large hæmorrhagy, being entirely confined to her bed, she determined to submit to the operation. The bladder and the intestines having been thoroughly cleared of their contents, she was placed without ligature or restraint of any kind in the usual obstetric position, on the left side, close upon the edge of the bed, with the shoulders forward, the loins posteriorly, the knees and bosom approximated, so that the thighs lay before the abdomen, the spine somewhat incurvated, and the front of the body facing a little toward the bed; in a word, the members of the body were composed much after the same manner as the fœtus in utero. The operator then kneeling close at the foot of the bed, the index and second finger of his left hand were carried along the back of the vagina to the line of union between the diseased and healthy structure. This accomplished, by means of a pointed blade with cutting edge, not unlike a dissecting scalpel, mounted upon a stem handle ten or eleven inches in length, stiff yet flexible, the fore finger of the left hand was, as it were, converted into a cutting point, the blade, for this purpose, being carried about one-eighth of an inch beyond the

tip of the finger. Thus a transverse opening was gradually made through the back of the vagina, towards the front of the rectum, into the recto vaginal portion of the peritonæal cavity, the knife being frequently withdrawn below the tip of the finger and the part delicately investigated by the finger so as to ascertain when the vaginal texture was cut through. An opening as large as the orifice of the urethra having in this manner been warily effected, and the knife being drawn down, the index finger was made into a kind of dilator, which bearing out through the aperture, enlarged its dimensions without the risk of wounding any of the contents of the peritonæum. The knife being again raised, so that its point was guarded by the tip of the index, and its cutting edge advanced beyond the side of the finger, so as to communicate to it laterally a cutting power, and thus convert it into a temporary knife possessing the advantage of sensibility; the incision was carried through the vagina transversely, to the root of the broad ligament on the left or under side of the pelvis. It was now easy by reversing operations, and communicating the cutting power by means of the mounted blade, to the fore-finger laterally on the other side, to carry the transverse incision through the vagina, up to the root of the broad ligament on the right or superior side of the pelvis. At this time the intestines could be felt, and steadiness and caution became of great importance. The transverse incision through the back of the vagina having been effected in this manner, without injury to contiguous parts, the whole of the left hand was cautiously, yet resolutely, passed into the vaginal cavity below, the first and second fingers were carried through the opening, and so far advanced that their tips were nearly brought into contact with the abdominal integuments, an inch or two above the symphysis pubis, and posteriorly they reached to the vicinity of the fundus uteri. The uterus itself could not, however, in this instance, owing to its lubricity and rotundity, be brought down by them; it was therefore necessary, under guard of the fingers, which lay on the back of the womb, to insert a double hook into the middle of its body. This was attended with little pain to the patient, and then, by the action of the hook, the entire uterus being cautiously drawn towards the point of the coccyx, while at the same time the fingers were urged onwards and incurvated over the descending fundus, this part of the hand, so important in the whole operation, was used as a blunt hook, by means of which the womb was retroverted into the hollow of the palm, just within the genital fissure. It was now in great measure under view, its fundus lying in the vicinity of the coccyx, and its mouth upon the neck of the bladder. The sides of the uterus retained their connexion with the pelvis, through the medium of the broad ligaments which were put moderately on the stretch. Under these circumstances the rest of the operation was easily completed by a narrow bistoury; the broad ligaments were cut through, and, great care being taken to avoid the uterus, the diseased mass was dissected away from the neck of the bladder, which was drawn down almost within sight. The operation was facilitated by previous child-bearing, although, notwithstanding the discharge, there was little tendency to prolapsus uteri. Though the womb had bled so freely before the operation, owing to the weakness of the circulation and other causes, yet not more than four or five ounces of blood were effused during its progress, the greater part coming away when the diseased structure was detached from the bladder and vagina in front. The pain was not greater than that of an instrumental delivery, nor perhaps so great, nor did the patient require to be at all confined. The principal suffering was experienced when the vagina was divided behind, and when it was dilated by the introduction of the hand. There was no decided collapse when the peritonæum was first laid open, the intestines approached the aperture, but did not protrude; after the operation the sides of the vagina collapsed, and the aperture above seemed to be covered by a retroversion of the bladder. An indurated portion of the left side of the vagina, as large as the first joint of the little finger, was separately detached by the knife after the completion of the rest of the operation. The pulse was distinct enough in the wrist during the greater part of the time; but when the diseased portions had been completely removed, on the occurrence of the hæmorrhage before mentioned, the beat of the radial artery was lost for about five minutes, the respiration being very feeble, and the patient lying, as after large floodings, very quiet. When brought to greater perfection, this method of operation will probably not occupy many minutes; but in this instance, that it might be done more safely, it was performed very slowly, and, like some deliveries by the forceps, it required more than an hour for its completion. It was not necessary in this case to vary the posture, the horizontal position being maintained throughout. The first incision was made at four o'clock, and the extirpation was finished by a quarter past five. Two ounces of gin and water were given during the operation, and the same quantity after its termination, with sixty drops of the tincture of opium. Previously to the operation the pulse was 120, tongue clean and rather white, and her manner composed; during its continuance, and when at the height of agitation, it rose to 140 in the minute, when she became faint, and approached nearly to a state of asphyxia. Two hours subsequently to the operation she was lying comfortably as if asleep, the whole body was warm, the pulse ninety-two and distinct, and the manner and countenance encouraging. On the third day there was great agitation and vomiting, and the pulse 112, without any obvious cause. Considerable solicitude was now entertained respecting her; but, happily, every uncomfortable symptom disappeared when the bowels were freely relieved. For ten days there was a reddish-brown discharge, and then for eight or nine more days it assumed a muco-purulent character, the flow from the vagina ceasing in a great measure on the nineteenth, and altogether on the twenty-first day. Shooting pain was more or less felt during the first three weeks after the removal of the uterus, on the left side, especially where the crural nerve is crossing the brim of the pelvis, under Poupart's ligament.

She is now, at the expiration of nearly six weeks, perfectly well.

375. *Of puerperal mania and phrenitis.*—All women, in the puerperal state, are more irritable, and more easily affected, both in body and mind, than at other times, and some even become delirious. The period at which this mental disease appears is various, but it is seldom if ever sooner than the third day, often not for a fortnight, and in some cases not for several weeks after delivery. It usually appears rather suddenly; the patient awakening, perhaps, terrified from a slumber, or it seems to be excited by some casual alarm. She is sometimes extremely voluble, talking incessantly, and generally about one subject, supposing, for example, that her child is killed, or stolen; or, although naturally of a religious disposition, she may utter volleys of oaths with great rapidity. In other cases she is less talkative, but is anxious to rise and go abroad. It is not, indeed, possible to describe the different varieties of incoherence, but there is oftener a tendency to raving than melancholy. She always recognises surrounding objects, and either answers any question put to her, or becomes more exasperated by it. She can by dint of perseverance, or by proper management, be for a time interrupted in her madness, or rendered in some degree obedient. In some instances she reasons for a little pretty correctly on her insane idea. The eye has a troubled appearance, the pulse, when there is much nervous irritation, or bodily exertion, is frequent, but it is not in general permanently so, though it is liable to accelerations; the skin is sometimes rather hot, the tongue white; the secretion of milk is often, but not always diminished; and the bowels are usually costive. There is seldom permanent headach; but this symptom is sometimes produced pretty severely by attempts to go to stool, if accompanied by tenesmus, or by efforts to void urine in strangury. In some instances the patient recovers in a few hours, in others the mania remains for several weeks, or even some months; but I believe it never becomes permanent, nor does it prove fatal unless dependent on phrenitis. Venesection has been advised in this disease; but I agree with those who consider it as hurtful, or at least as useless. The best practice, I think, is to apply leeches to the temples, open the bowels with a smart dose of calomel, keep the surface gently moist by means of saline julap, and afterwards allay irritation with liberal doses of camphor. Blisters have by some, for whose opinion I have much regard, been considered as useless, or detrimental; but I am confident I have seen them do good after they had discharged freely. Opium is a very doubtful remedy; it oftener makes the patient restless, than procures sleep; but in the wane of the disease it does in some cases agree with the patient, and is productive of great benefit. There is sometimes considerable difficulty in keeping the patient in bed, and making her take either food or medicine. It is therefore of great advantage to have early recourse to the strait waistcoat, which not only commands the patient, but tends to make her exercise self control. In the progress of the disease attention must be paid to the bowels, and it must be remembered that often the patient voids both urine and fæces without telling, not from being unable to retain them, but from inattention or perversity. The mind is not at first the subject of management, but, in the progress of the complaint, it may by prudent efforts be aided in convalescence by cheerful conversation, light reading, music, and afterwards by daily walking and change of scene.

376. Some are peculiarly liable to this disease after delivery, in consequence of the irritable state of the nervous system at that time. In such cases the patient must be carefully watched after parturition. Every irritation must be removed, every source of alarm or agitation obviated, and the camphorated julap with gentle laxatives will be proper remedies, these being the most powerful means of diminishing the excessive irritability of the nervous system. The diet is also to be regulated. If the patient do not sleep well hyoscyamus should be given. It is often of service to get the patient up as soon as can be done with safety, and have the mind occupied with such amusements and pursuits as keep it equally exercised, without risking irritation.

377. Melancholy usually comes on later than furious delirium. The disease differs nothing in appearance and symptoms from melancholy madness occurring at other times. It is obstinate; but generally goes off after the child is weaned, and the strength returns. It is therefore proper to remove the child, and send the patient to the country as soon as possible. In some instances both kinds of madness seem to be dependent on a morbid irritation, such as inflammation of the mamma, &c. Here our attention must be directed to the cause.

378. Inflammation of the brain usually appears still earlier than delirium from irritation. It may be caused by determination of blood to the head, or preternatural irritability of the sensorium, or may occur in consequence of a constitutional tendency to mania. It must be distinguished from puerperal delirium which is seldom dangerous, whilst this is a most fatal disease. It generally appears within the third day after parturition, but it may also take place later. The pulse usually continues frequent from the time of delivery. The patient does not sleep soundly, and indeed is watchful. She soon complains of throbbing within the head, or in the throat, or ears; then of confusion, hears acutely, dislikes the light, and speaks in a hurried manner, and often is unusually interested about some trifle. Then all at once furious delirium comes on. She talks rapidly and vociferously, the eyes move rapidly, are wild and sparkling, and very sensible to the light. This state may continue, with little interruption, till symptoms of compression appear, or there may be a short interval of reason, but presently the furor returns, and alternates perhaps with sullenness. The case is in these respects modified according to the inflammation; for sometimes it comes on rapidly and to a great extent, at other times it proceeds more slowly. The lochia are not suppressed, nor are the bowels bound, but the secretion of milk ceases. In three or four days she becomes paralytic in one side, and then sinks into a low comatose

state; the extremities become cold, the breathing laborious, and sometimes convulsions precede death. This disease requires the prompt and early use of the antiphlogistic treatment, general and local blood-letting, the use of purgatives, and the application of a blister to the scalp. The inflammatory symptoms being subdued, the delirium abates, or goes off, by the use of remedies formerly pointed out.

379. *Of hysteralgia.*—By hysteralgia I understand uterine pain proceeding from spasm, and not from inflammation. This may occur soon after delivery, and is marked by severe pain in the back and lower belly, frequent feeble pulse, sickness, and faintness. This is sometimes accompanied with discharge, or succeeded by expulsion of a coagulum. It requires an opiate immediately. Another modification of this comes on later, but always within three or four days after delivery, and attacks in general very suddenly. Perhaps the patient has risen to have the bed made, becomes sick, or vomits, and is seized with violent pain in the lower part of the belly, or between the navel and pubis. There is no shivering, at least it is not a common attendant, and the pulse becomes very rapid, being sometimes above 120, the skin is hot, the lochia usually obstructed, and the uterine region somewhat painful on pressure. After some hours the severity abates, and presently, by proper means, the health is restored.

380. As the lochial discharge is usually obstructed, this obstruction has been considered as the cause of the pain and other symptoms; but it is merely an effect, and sometimes does not exist. The cause appears to consist in a deranged state of action in the uterus, which is productive of spasm of the uterine fibres, and sometimes of the intestines. This is more apt to occur after a severe or tedious, than after an easy labor; but it may occur in any case, especially if exposed to cold. The symptoms will vary a little in severity and in appearance, according as the uterus alone is affected, or as spasm of the bowels is combined with the uterine pain. It is distinguished from inflammation by the sudden nature of the attack, the absence of shivering in general, the pain becoming speedily more severe than it does at the same period of inflammation; and frequently it greatly remits, or goes almost entirely away for a short time, It is possible, however, for this state, especially if it be neglected, to excite inflammation, which is marked by constant pain, more or less severe according to the part affected, and an obstinate continuance of the fever.

381. The first thing to be done is to administer a turpentine clyster to open the bowels. Then the belly is to be fomented, and, if speedy relief be not obtained by these means, an anodyne injection is to be given, and the saline julap is to be taken freely, with the addition of a little antimonial wine, in order to excite a free perspiration. If the symptoms continue, I strongly advise the detraction of blood. Purgatives are useful, and a blister must be applied to the pained part of the belly to prevent inflammation.

382. *Of diarrhœa.* If the patient have been costive before delivery, large masses of fæces may come down afterwards, producing violent pains in the belly, piles, tenesmus, or uterine hæmorrhage; or the same cause may excite diarrhœa with the passage of scybalæ. Both states require the use of gentle laxatives. Diarrhœa may also occur without previous costiveness; the stools are then fœtid or bilious. In this case the diet is to be strictly regulated; gentle laxatives are to be first given to evacuate the offensive matter, and then opiates are to be immediately resorted to. If neglected, great weakness, uterine hæmorrhage, or other serious consequences may be produced. When it is accompanied with bilious vomiting, and cramps or spasms, opiates are the principal remedy, and these must, if vomited, be given in the form of clysters.

383. *Of the signs that a woman has been recently delivered.*—We discover that a woman has been recently delivered, by finding that the external parts are relaxed, and redder, or of a darker color than usual. There is a sanguineous or lochial discharge. The uterus is enlarged, and has neither the shape of the gravid or unimpregnated uterus; the cervix is indistinct, and the os uteri is nearly circular, and will admit two or more fingers. The abdomen is prominent, and the integuments relaxed, wrinkled, and covered with light-colored broken streaks. The breasts are enlarged, have the areola very distinct, and contain milk; but it is possible for this secretion to take place independently of pregnancy. By examination per vaginam, within a fortnight or three weeks after delivery, the uterus may still be felt larger than usual, its lips softer, and capable of admitting the point of the finger without much difficulty. The milk at this period will not have left the breasts, which are firm, and have a dark areola round the nipple. Very contradictory accounts have been given by anatomists, of the appearance and size of the uterus, when inspected at different periods, after delivery. If the woman die of hæmorrhage, or from any cause destroying her, soon after delivery, the uterus is found like a large flattened pouch, from nine to twelve inches long. The cavity contains coagula or a bloody fluid, and its surface is covered with remains of the decidua. Often the marks of the attachment of the placenta are very visible. This part is of a dark color, so that the uterus is thought to be gangrenous, by those who are not aware of the circumstance. The surface being cleaned, the sound substance of the womb is seen. The vessels are extremely large and numerous. The fallopian tubes, round ligaments, and surface of the ovaria, are so vascular, that they have a purple color. The spot where the ovum escaped is more vascular than the rest of the ovarian surface. This state of the uterine appendages continues until the womb has returned to its unimpregnated state. It is a month at least, before the uterus return to its unimpregnated state, but the os uteri rarely, if ever, closes to the same degree as in the virgin state. We know that the woman has had a recent miscarriage, by the state of the breasts, the sanguineous discharge from the vagina, the size of the uterus, and the softness and dilatation of its mouth. If the woman die, the womb is found enlarged, its inner surface

covered with the decidua, or maternal portion of the placenta. The vessels are enlarged, the tubes and ligaments very vascular; the calyx of the ovum is bloody. This, at a more advanced period, forms a kind of cicatrix, or a dusky yellowish body, called corpus luteum. This mark may exist, although the woman have not borne a child, for the ovum may be blighted, perhaps even in the ovarium. It has been conjectured by some, that it may be produced even without sexual intercourse, but this point cannot be determined. It is supposed, however, that in such cases, the marks are not real corpora lutea; they have not ever been injected.

INDEX.

As the numbers are not prefixed to the paragraphs in the first part of the article, we have indicated some of the particulars pointed out in the following index by the page, and have then placed p. before the number.

MIEL (John), or Giovanni della Vite, a most eminent painter born in Flanders in 1599. He was a disciple of Gerard Seghers, and afterwards visited Italy to improve his style. At Rome he studied the works of the Caracci and Corregio; and was admitted into the academy of Andrea Sacchi. But he preferred the style of Bamboccio, whom he equalled. His general subjects were hunting, carnivals, gypsies, beggars, and pastoral scenes. But his easel pictures are his finest performances. He also painted historical pieces in a large size in fresco, and in oil. His pictures of hunts are particularly admired; the figures and animals being designed with uncommon spirit and truth. The transparence of his coloring, and the clear tints of his skies, enliven his compositions. His merit recommended him to Charles Emmanuel duke of Savoy, who invited him to his court, appointed him his principal painter, honored him with the order of St. Mauritius, and gave him a cross set with diamonds of great value. He died in 1664.

MIEN, *n. s.* Fr. *mine;* there is also a Dan. and Swed *mene;* Isl. *mena.* Look; countenance; behaviour; manner.

In her alóne that owns this book is seen
Clorinda's spirit, and her lofty *mien.* *Waller.*

What can have more the figure and *mien* of a ruin than craggs, rocks, and cliffs? *Burnet.*

She asked the reason of his woe;
She asked, but with an air and *mien*
That made it easily foreseen
She feared too much to know. *Prior.*

What winning graces, what majestic *mien!*
She moves a goddess, and she looks a queen. *Pope.*

Yours is, she said, the nobler hue,
And yours the statelier *mien!*
And, till a third surpasses you,
Let each be deemed a queen. *Cowper.*

Hail, Innocence! whose bosom all serene,
Feels not fierce passion's raving tempest roll!
Oh ne'er may Care distract that placid *mien!*
Oh ne'er may Doubt's dark shades o'erwhelm thy soul! *Beattie.*

With all that chilling mystery of *mien,*
And seeming gladness to remain unseen,
He had (if 'twere not nature's boon) an art
Of fixing memory on another's heart. *Byron.*

MIERIS (Francis), the Old, a justly celebrated painter, born in Leyden in 1635. He was at first placed under Abraham Toorne Vliet, and afterwards became a disciple of Gerrard Douw. He soon far surpassed all his companions. His pictures have been sold at vast sums. He painted silks, velvets, carpets, &c., in a peculiar manner. Portraits, conversations, musicians, patients attended by the doctor, chemists at work, mercers' shops, &c., are his usual subjects. It is his attention to minutiæ, united to breadth and truth, which give so much value to his works; which are very rare, and of course very costly. His own valuation of his time was a ducat an hour: and for one picture of a lady fainting, with a physician attending her, and applying remedies, he was paid at that ratio, so large a sum as 1500 florins. The grand duke of Tuscany is said to have offered 3000 for it, but was refused. Several of his pictures are still an ornament to the Florentine collection. One of them, a girl holding a candle, is accounted the most valuable. Houbraken mentions an incident in his life, which, as it tends much to his honor, may not be unacceptable to the reader. Mieris had conceived a real friendship for Jan Steen, and delighted in his company, though he was by no means so fond of drinking freely as Jan was accustomed to do every evening at the tavern. Notwithstanding this he often passed whole nights with his friend, in a joyous manner, and frequently returned very late to his lodgings. One evening, when it was very dark, and almost midnight, as Mieris strolled home from the tavern, he unluckily fell into the common sewer, which had been opened for the purpose of cleansing, and the workmen had left it unguarded. There he must have perished, if a cobbler and his wife, who worked in a neighbouring stall, had not heard his cries, and instantly run to his relief. Having extricated Mieris, they took all possible care of him; and procured the best refreshment in their power. The next morning, Mieris having thanked his preservers, took his leave; but particularly remarked the house, that he might know it another time. The poor people were totally ignorant of the person who had been relieved by them, but Mieris had too grateful a spirit to forget his benefactors, and, having painted a picture in his best manner, he brought it to the cobbler and his wife, telling them it was a present from the person whose life they had contributed to save; and desired them to carry it to his friend Cornelius Plaats, who would give them the full value for it. The woman, unacquainted with the real worth of the present, concluded she might receive a moderate gratuity for the picture; but her astonishment was inexpressible when she received the sum of 800 florins. He died in 1681.

Mieris (John), son of Francis, was born in Leyden in 1660, and learned the art of painting from his father. He travelled to Germany and thence to Florence, where his father's merit procured him an honorable reception from the grand duke, who wished to retain him in his service. But Mieris declined it, and proceeded to Rome, where his great abilities were well known, and his works much sought after. In that city he continued to work with great application, till an attack of the stone ended his days in 1690, when he was only thirty.

Mieris (William), called the Young Mieris, brother to John, was born in Leyden in 1662. During his father's life he made a remarkable progress; and after his death, by studying nature nearly equalled his father. He painted Rinaldo sleeping on Armida's lap, which sold at a high price. He also painted landscapes and animals with great truth; and he modelled in clay and wax in a very accurate manner. He is allowed to have been an artist of extraordinary merit. He died in 1747.

MIGDOL, or Magdol, in ancient geography, a place in the Lower Egypt, on this side Pihahiroth, or between it and the Red Sea, towards its extremity. The name denotes a tower or fortress It is probably the Magdolum of Herodotus, as the Septuagint render it by that name.

MIGHT. The preterite of may. See May.

MIGHT, *n. s.* } Sax. mıȝht, or maȝht; Goth. and Dan. *maght* (Goth. *meigu*, to have power). Strength; power; force: mighty is, strong; powerful; influential; hence valiant; great in number; vast; bulky; efficacious; excellent in any way; important: as an adverb, in low language, in a great degree: mightily and mightiness follow these senses.
MI'GHTY, *adj.* & *adv.*
MI'GHTILY, *adv.*
MI'GHTINESS, *n. s.*

Nimrod began to be a *mighty* one in the earth. *Genesis.*

They sank as lead in the *mighty* waters. *Exodus.*

Intreat the Lord, for it is enough, that there be no more *mighty* thunderings and hail. *Id.*

Woe to them that are *mighty* to drink wine. *Isaiah.*

If the *mighty* works which have been done in thee had been done in Sodom, it would have remained. *Matthew.*

Right so, quoth he, but he that never would,
Could never; will to *might* gives greatest aid. *Spenser.*

With whom ordinary means will prevail, surely the power of the word of God, even without the help of interpreters, in God's church worketh *mightily*, not unto their confirmation alone which are converted, but also to their conversion which are not. *Hooker.*

An oath of mickle *might*. *Shakspeare. Henry V.*

Do as adversaries do in law, strive *mightily*, but eat and drink as friends. *Shakspeare.*

There's ne'er a one of you but trusts a knave
That *mightily* deceives you. *Id.*
Think you see them great,
And followed with general throng and sweat
Of thousand friends; then, in a moment, see
How soon this *mightiness* meets misery. *Id.*

I'll sing of heroes and of kings,
In *mighty* numbers, *mighty* things. *Cowley.*
Wherefore should not strength and *might*
There fail, where virtue fails? *Milton's Paradise Lost.*
The Creator, calling forth by name
His *mighty* angels, gave them several charge. *Milton.*

Amazement seized
The rebel thrones, but greater rage to see
Thus foiled their *mightiest*. *Id.*
Giants of *mighty* bone and bold emprise. *Id.*
Lydiate excelled the *mighty* Scaliger and Selden. *Echard.*

With *might* and main they chaced the murderous fox,
With brazen trumpets and inflated box. *Dryden.*
Jove left the blissful realms above,
Such is the power of *mighty* love. *Id.*
The *mighty* master smiled. *Id.*

An ass and an ape conferring on grievances; the ass complained *mightily* for want of horns, and the ape for want of a tail. *L'Estrange.*

I was *mightily* pleased with a story applicable to this piece of philosophy. *Spectator.*

This privilege the clergy in England formerly contended for with all *might* and main. *Ayliffe.*

Lord of his new hypothesis he reigns;
He reigns: How long? Till some usurper rise,
And he too, *mighty* thoughtful, *mighty* wise:
Studies new lines. *Prior.*

These happening nearer home made so lasting impressions upon their minds, that the tradition of the old deluge was *mightily* obscured, and the circumstances of it interwoven and confounded with those of these later deluges. *Woodward.*

Thou fallest where many *mightier* have been slain. *Broome.*

The enemies of religion are but brass and iron, their mischiefs *mighty*, but their materials mean. *Delany.*

Linked with success, assumed and kept with skill,
That moulds another's weakness to its will;
Wields with their hands, but, still to these unknown,
Makes even their *mightiest* deeds appear his own. *Byron.*

MIGNARD (Nicholas), a very ingenious French painter, born at Troyes in 1628; but, settling at Avignon, he is generally styled Mignard of Avignon. He was afterwards employed at court, and became rector of the royal academy of painting at Paris. There were many of his historical pieces and portraits in the palace of the Thuilleries. He died in 1690.

MIGNARD (Peter), the brother of Nicholas, was born at Troyes in 1640; and acquired much of the taste of the Italian school. He had a superior genius to his brother. He painted popes Alexander VII. and Urban VIII., many of the Roman nobility, several Italian princes, and Louis XIV., who ennobled him, made him his principal painter, and appointed him director of the manufactories. Almost all the illustrious nobles of the French court followed the example of their sovereign, and were painted by Mignard. His style of execution in these portraits is wrought up with all the false taste and pompous parade which distinguished that period of the French nation; when parade passed current for true splendor; what was only specious or subtle, was received as useful and learned; and bombast assumed the station due only to true dignified simplicity. His pictures are all flutter; every thing seems in motion; even when the scene is laid in a close room, the draperies are flying about as in a high wind. The actions of his figures are in assumed airs; like pompous, and not unfrequently bad actors; and the coloring of his pictures, though fresh and vigorous, is not true, but teinted, and reminds the observer of the palette. With these defective points in his character, as an artist, Mignard is not unworthy of regard. His drawing is correct: his arrangement of parts is ingenious: and his invention fertile. He contrived to make his pictures ornamental, and is the best portrait painter of the French school. He died in 1695.

MIGNON, or MINJON (Abraham), a celebrated painter of flowers and still life, born at Frankfort in 1639. His father left him in very necessitous circumstances when only seven years of age. James Murel, a flower painter in that city, took him into his house, instructed him in his art till he was seventeen years old, and afterwards took him to Holland, where he placed him as a disciple with David De Heem, whose style Mignon imitated and adhered to; adding daily to his improvement by studying nature. He was well paid for his works. Weverman mentions one of a most capital kind, in which a cat has thrown down a pot of flowers that lie scattered on a marble table. It is so wonderfully natural that the spectator can hardly persuade himself that the water spilt from the vessel is not really running down from the marble. Mignon died in 1679, aged forty.

MIGNOT (Stephen), a member of the Academie des Inscriptions, France, was born in 1698, and graduated D. D. in 1722. He was the author of a variety of tracts, upon subjects connected with the discipline of the church of Rome. The principal are, A History of the Disputes between king Henry II. of England, and St. Thomas à Becket, 12mo.; On the Rights of the Monarch and the Civil Government over the Revenues of the Church, 6 vols.; A History of the Reception of the Council of Trent in the Catholic States, 2 vols.; The real History of the Church of St. Omer; A Paraphrase on the Psalms; and an elaborate treatise, Des prêts de Commerce, in five duodecimo volumes. He died in 1771.

MIGNOT (Vincent), a nephew of the celebrated Voltaire, was born at Paris in 1730, and obtained, without being a priest, several benefices, among which was the abbey of Sellieres. He became counsellor to the grand council, which place he resigned in 1765, reserving to himself the honorary title. In conjunction with the marquis de Ville-Vielle, he signed the profession of faith which Voltaire is said to have made just before his death; and transported the remains of that individual to the abbey of Sellieres, whence they were subsequently removed to the pantheon, or church of St. Genevieve, Paris. Mignot was the author of Histoire de l'Empire Ottoman, depuis son Origine jusqu'a la Paix de Belgrade, en 1740, Paris, 1771, 4 vols. 12mo., of which there is an English translation; Histoire de l'Imperatrice Irene, 1760 12mo.; Histoire de Jeanne I., Rein de Naples, 12mo.; Histoire des Rois Catholiques Ferdinand et Isabelle, 2 vols. 12mo.; and he translated Quintius Curtius, and Cicero de Senectute and de Amicitiâ. His death took place in 1790.

MI'GRATE, *v. a.*, MIGRA'TION, *n. s.*, MI'GRATORY, *adj.* } Lat. *migro*, *migratio*. To change residence or place of abode; to wander: migration, the act or habit of changing residence; removal.

Aristotle distinguisheth their times of generation, latitancy and *migration*, sanity and venation.
Browne's Vulgar Errours.

Although such alterations, transitions, *migrations* of the centre of gravity, and elevations of new islands, had actually happened, yet these shells could never have been reposed thereby in the manner we find them. *Woodward's Natural History.*

Besides the swallow, Mr. Pennant enumerates many other birds which *migrate* from Britain at different times of the year, and are then to be found in other countries; after which they again leave these countries, and return to Britain. The reason of these *migrations* he supposes to be a defect of food at certain seasons of the year, &c. *Dr. M. Good.*

MIGRATION OF BIRDS. It is generally believed that many different kinds of birds annually pass from one country to another, and spend the summer or winter where it is most agreeable to them; and that even the birds of our own island seek the most distant southern regions of Africa, when directed by a peculiar instinct to leave their own country. It has long been an opinion pretty generally received that swallows reside during winter in the warm southern regions; and Pennant enumerates many other birds which migrate from Britain at different times of the year, and are then to be found in other countries; after which they again leave these countries, and return to Britain. The reason of these migrations he supposes to be a defect of food at certain seasons of the year, or the want of a secure asylum from the persecution of man during the time of courtship, incubation, and nutrition. See ORNITHOLOGY.

MIGUEL (St.), or ST. MICHAEL, one of the principal and most fertile of the Azores. It appears to be entirely volcanic. A good account of it was published in the Philosophical Transactions, vol. lxviii. by Masson. 'The productions,' he says, 'differ greatly from those of Madeira. None of the trees of the latter are found in it except the saya. The mountains are covered with the erica vulgaris, and an elegant ever-green shrub very like a phyllyrea, which gives them a most beautiful appearance. It lies nearly east and west. Its length is about eighteen or twenty leagues; its breadth from two to five leagues, and its circumference sixty miles. It contains about 80,000 inhabitants, who carry on a considerable trade in corn, wine, and cattle. Its capital Ponta del Guda, or Punta del Guada, is situated on the south side of the island, on a fine fertile plain, and pretty regularly built; the streets are straight, and of a good breadth. It is supplied with good water, from mountains nine miles distant. The churches are elegant and well built. There is a large convent of Franciscan friars, another of those of St. Augustin, four convents for professed nuns, and three recolhimentos for young women and widows not professed. The vessels anchor in an open road, but it is not dangerous, as no wind can prevent their going to sea in case of stormy weather. The country around the city is plain for several miles, well cultivated, and laid out with good taste into spacious fields, which are sown with wheat, barley, Indian corn, pulse, flax, &c., and commonly produce annually two crops. The soil is remarkably easy to work, being mostly composed of pulverised pumice-stone. There are in the plains a number of pleasant country seats, with orchards of orange trees, esteemed the best in Europe. The second town is Ribeira Grande, on the north side of the island, containing a large convent of Franciscan friars, and one of nuns. The third town is Villa Franca, on the south side of the island, about eighteen miles east of the capital. It has a convent of Franciscan friars, and one of 300 nuns. About half a mile from the shore lies a small island called Ilhao, which is hollow in the middle, and contains a fine basin with only one entrance into it fit to hold fifty vessels secure from all weather. There are also several smaller towns viz. Alagoa, Agoa de Pao, Brelanha, Fanaes de Ajuda, and many hamlets. About twelve miles north-east of Villa Franca lies Furnas, a round deep valley, in the east part of the island, surrounded with high mountains, and about eighteen miles in circuit. The mountains are very steep, covered with beautiful ever-greens, and numberless rivulets run down their sides. The valley is well cultivated, and the fields are planted round with beautiful pyramidal poplars; which with a number of boiling fountains throwing up clouds

of steam, and a fine lake in the south-west part about six miles round, compose a prospect the finest that can be imagined. In the valley the roads are smooth and easy, there being no rocks but a fine pulverised pumice-stone. Of the numerous hot fountains in the valley, and on the sides of the mountains, the most remarkable is the Chaldeira, on a small eminence on the east by the side of a river, on which is a basin about thirty feet in diameter, where the water continually boils with prodigious fury. A few yards from it is a cavern in the side of the bank, in which the water boils in a dreadful manner, throwing out a thick, muddy, unctuous water several yards from its mouth with a hideous noise. In the middle of the river are several places where the water boils up so hot, that one cannot dip a finger into it without being scalded; along its banks are several apertures, out of which the steam rises to a considerable height, so hot that there is no approaching it; in other places one would think that a hundred smiths' bellows were blowing altogether, and sulphureous steams issuing out in thousands of places. Native sulphur is found in every chink, and the ground covered with it like hoar-frost. Near these boiling fountains are several mineral springs; two in particular whose waters have a very strong quality, of an acid and bitterish taste. About half a mile to the west, and close by the river, are several hot springs; and on the side of a hill west of St. Ann's Church are many others, with three bathing-houses. These waters are very warm, although not boiling hot; but at the same place issue several streams of cold mineral water, by which they are tempered, according to every one's liking. About a mile south of this place, and over a low ridge of hills, lies a fine lake about six miles in circumference, and very deep, the water thick, and of a greenish color. At the north end is a plain, where the sulphureous steams issue out in many places, with a surprising blowing noise. This lake seems to have no visible outlet. The other springs form a considerable river, called Quente, which runs about eight or nine miles through a deep rent in the mountains, and falls into the sea on the south side; near which are several places where the water boils up at some distance in the sea. This wonderful place had been little noticed until about thirty years ago, when some persons, afflicted with virulent disorders, tried its waters, and found immediate relief from them. Since that time it has been much frequented: several persons troubled with eruptions, and others who had lost the use of their limbs by the palsy, have been cured. A clergyman, a friar, and several gentlemen, afflicted with the gout, tried these waters, and were soon perfectly cured. The east and west parts of the island consist of high mountains, but the middle is low, interspersed with round conic hills, all of which have very recent marks of fire; the parts below the surface consisting of melted lava lying very hollow. Most of the mountains on the west have their tops hollowed out like a punch-bowl, and contain water. Near the west end is an immense deep valley, called Sete Cidades, surrounded with very abrupt mountains, about twenty-four miles round; in the bottom is a deep lake about nine miles in circuit, frequented by many water-fowls. All these mountains are composed of a white crumbly pumice-stone. This island was almost destroyed in 1638 by an earthquake, which continued eight days from the 26th of June. It lies in long. 22° 45′ W., lat. 38° 10′ N.

MIHIEL (St.), a little town of the department of the Meuse, France; the chief place of a canton in the arrondissement of Commercy. It has an inferior court for the arrondissement, and a court of assize for the department, a commercial college, and a post-office.

This town is situated in a pleasant valley on the right bank of the Meuse. In ancient times it was fortified, and endured several sieges at different periods, especially in 1635, when Louis XIII. attacked it in person, and narrowly escaped being killed before it; on this he caused its fortifications to be levelled with the ground. The inhabitants are manufacturers of cotton-cloths, woollen-drapery, and edge tools; they have also hydraulic cotton-spinning factories, forges, and tan-yards, and carry on a trade in corn, wine, wood, rape seed, table-linen, lace, paper, &c. In the parish church there is a beautiful monument of sculpture, worthy to fix the attention of all lovers of the fine arts. It is known by the name of the Sepulchre, and represents the tomb of Jesus Christ; it is made out of a single stone, of the production of the country, which for whiteness and fineness of grain almost equals marble. It is beautifully executed by Ligier Michier, a pupil of the celebrated Michael Angelo. Population 5200. This town is twelve miles north of Commercy, and twenty-four north-east of Bar-le-Duc. E. long. from Paris 3°, N. lat. 48° 56′.

MILAN, a late duchy of Italy, now included in the Austrian possessions of that peninsula, was bounded by the duchy of Savoy, the principality of Piedmont, and duchy of Montserrat, on the west; by Switzerland on the north; by the late Venetian territories, the duchies of Mantua, Parma, and Placentia, on the east; and by the Appennines and the Genoese territories on the south; extending about 100 miles from north to south, and 108 from east to west. It is esteemed one of the finest provinces in Italy, being watered by the Tessino, Sesia, Adda, Po, Oglio, Lambro, and other rivers, as well as by several canals and lakes; particularly lakes Como, Garda, Lugano, and Maggiore, which see. The whole of the Milanese, divided into four departments, was lately comprised in the Cisalpine republic; then in the kingdom of Italy: but on the reinstatement of the old order of things, in 1814, the part belonging to the king of Sardinia was restored, and the remainder incorporated with the Austrian, or Lombardo-Venetian kingdom of Italy. It there forms, along with the duchy of Mantua and the Valteline, the government of Milan, or more western of the two great divisions of Austrian Italy. Its extent is about 7700 superficial square miles, and its population 2,083,000. It is divided into the nine delegations of Milan, Pavia, Lodi, Como, Cremona, Sondrio, Bergamo, Brescia, and Mantua. Of these, that of Milan contains 670 square miles, and 427,000 inhabi

tants. The Sardinian, situated to the west of the Austrian Milanese, or government of Milan, and separated from it by the Ticino, a large river flowing from north to south, contains about 3300 square miles, and 556,000 souls, who inhabit eight large and 689 market-towns and villages. It is divided into the provinces or districts of Alessandria, Lumellina, Tortona, Voghera, Bobbio, Siccomario, Vigevanasco, Novara, and Sesia. See ITALY, AUSTRIAN.

Anciently this duchy, containing the north part of the old Liguria, was called Insubria, from its inhabitants the Insubres, who were conquered by the Romans, as these were by the Goths; who in their turn were subdued by the Lombards. See our article ITALY. Didier, the last king of the Lombards, was taken prisoner by Charlemagne, who put an end to the Longobardic empire, and appointed governors of Milan. These governors, being at a distance from their masters, soon began to assume an independency, which brought a dreadful calamity on the country; for, in 1152 the capital itself was levelled with the ground by the emperor Frederic Barbarossa, who committed great devastations throughout the duchy. Under this emperor flourished Galvian, a nobleman, descended from Otho, a Milanese. Galvian served with William prince of Montserrat, in the crusade, when Godfrey of Bouillon took Jerusalem: he killed in single combat the Saracen general, whom he stripped of his helmet, which was adorned with the image of a serpent swallowing a youth; and this ever afterwards was the badge of that family. His grandson Galvian, having opposed the emperor, was taken prisoner, and carried in irons into Germany, whence he escaped, and, returning to Milan, died in the service of his country. From him descended another Otho, at the time that Otho IV. was emperor, and who, being educated under cardinal Octavian Ubaldina at Rome, soon distinguished himself by his accomplishments.

In the mean time, Torriano, a nobleman of unbounded ambition, attempted to make himself master of Milan. The popular faction had for some time been caballing against the nobility; and this chief, putting himself at their head, expelled the bishop, and put to death or banished all the nobility: by which means the popular government was fully established; but Torriano ruled every thing. He was, however, soon opposed by Francis Sepri, who formed a party to deliver the city from his tyranny. But, while these parties were collecting their forces, cardinal Ubaldini was projecting the destruction of both, by means of his favorite Otho, whom he appointed archbishop of Milan; which was confirmed by pope Urban IV. The nobility now began to gather strength. Otho had no sooner procured a show of an army than he advanced towards Lake Maggiore, and took Arona, a strong post near that lake: but Torriano, marching against him with all his troops, obliged him to abandon the place. This was followed by the destruction of the castles of Arona, Anghiari, and Brebia: soon after which Torriano died, and was succeeded by his brother Philip, who got himself elected prætor of Milan for ten years. During his life, however, the party of the nobility increased considerably under Otho. Philip died in 1265, with great reputation for courage and conduct.

His successor Napi rendered himself terrible to the nobility, many of whom he proscribed and put to death. He acted with such fury, against that unfortunate party, that pope Clement IV. interdicted Milan, and excommunicated Napi and all his party. On this Napi began to lose his popularity, and Otho kept up the spirit of his party, who chose for their general Squarcini Burri, a man of great courage, whose daughter was married to Matthew Visconti, afterwards called Matthew the Great. At the same time they renewed their confederacy with the marquis of Montserrat, who was son-in-law to the king of Spain. The nobility having collected an army, which was joined by 600 Spanish cavalry, and a body of foot, gained some advantages. But in the mean time, Napi, having gathered together a superior army, attacked Otho and Burri, whom he defeated. After this disaster Otho applied to the pope; and Napi invited the emperor Rodolph into Italy, who constituted Napi his governor and vicar-general in Lombardy, and sent him a body of German horse, the command o which was given to Cassoni, Napi's nephew.

The Milanese exiles, however, soon became formidable, and chose for their general Godfrey, count of Langusio, a noble Pavian, who, being rich and powerful, enlisted many German mercenaries, at whose head he marched towards the lake Maggiore. All the towns in that country opened their gates to him, through the interest of the Visconti family. Godfrey being defeated and taken prisoner, he and thirty-four nobles had their heads struck off. This defeat greatly affected Otho; but after several battles, with alternate success, Otho totally defeated and took prisoner Napi himself. After this victory Cassoni was obliged to abandon Milan, and Otho kept possession of it till 1295, when he died, aged eighty-seven. He was succeeded by Matthew Visconti above-mentioned; and Milan continued in subjection to that family without any remarkable occurrence till 1378, when, by the death of Galeatius or Galeazzo II., his brother Barnabas became sovereign of Milan. He was brave and active, but excessively profuse in his expenses, as his brother Galeazzo had also been; and, to procure money to supply his extravagancies, resorted to every kind of oppression.

Galeazzo had engaged in an enterprize against Bologna, and the siege of it was continued by Barnabas. It lasted nine years; and cost nearly £40,000,000 sterling. Both the brothers were excessively fond of building. Barnabas erected a bridge over the Adda, consisting of three stories; the lowest for chariots and heavy carriages, the middle for horses, and the uppermost for foot passengers. He built another bridge which was carried over houses. To accomplish these, and other expensive schemes, he became very tyrannical, and every day produced fresh instances of his rapacity and cruelty. He instituted a chamber of enquiry, for punishing all those who had for five years before been guilty of killing boars, or even of eating them. They

who could not redeem themselves by money were hanged, and above 100 wretches perished in that manner. Those who had any thing to lose were stripped of their substance, and obliged to labor at the public works. He obliged his subjects to maintain his hunting dogs, and each district was taxed a certain number. This tyranny rendered the public ripe for a revolution, which was accomplished by his nephew John Galeazzo. He affected a solitary, devout life, void of ambition; but in the mean time had spies at his uncle's court, who gave him information of all that passed. Under pretence of paying a vow, to visit the church of the blessed Virgin upon mount Varezzio, he led Barnabas and two of his sons to accompany him to a private place on the road, where he had soldiers placed to seize them; and the houses of those who had followed them were given up to be plundered. The booty in plate, money, and rich furniture, was immense. The ministers of Barnabas were put to death; the citadel fell into the hands of Galeazzo, who found in it an immense sum of money. Barnabas was carried prisoner to his castle of Tritici, where his mistress, Dominia Porra, shut herself up a voluntary prisoner with him, and remained with him as long as he lived, which was only seven months after his degradation.

John Galeazzo was the first who took the title of duke of Milan. He made war with the Florentines, took Pisa and Bologne, and defeated the emperor in 1401, so that he entertained hopes of becoming master of all Lombardy; but his designs were frustrated by death, in 1402, in his fifty-fifth year. After his decease the Milanese fell into the most violent distractions, so that the government could not be supported, even in peace, without an army of 20,000 foot and as many horse. In 1421, however, Philip duke of Milan became master of Genoa: but, though he gained great advantages in all parts of Italy, the different states still found means to counterbalance his successes, and prevent him from enslaving them: so that Milan never became the capital of any extensive government; and in 1437 Genoa revolted, never afterwards to be reduced. Philip died in 1448, and by his death the male line of the Visconti family was ended. The next lawful heir was Valentina his sister, who had married the duke of Orleans, son to Charles V. of France. By the contract, the lawful issue of that marriage were to succeed to the duchy of Milan, in failure of the heirs male of the Visconti family; but this succession was disputed by Sforza, who had married Philip's natural daughter, and who obtained possession of the duchy. Louis XII., however, afterwards put in his claim, as grandson to John Galeazzo. For some time he was successful; but the French behaved in such an insolent manner that they were driven out of the Milanese by Maximilian Sforza and the Swiss. The Swiss and Milanese were now in their turn expelled by Francis I., who obliged the Sforza family to relinquish the government for a pension of 30,000 ducats a-year. Francis Sforza, the son of Maximilian, however, being assisted by the emperor and the pope, regained the possession of the Milanese about 1521; and, in 1529, the French king, by the treaty of Cambray, gave up his claim on the duchy. The emperors of Germany, however, seem to have had the fairest title to the Milanese in right of their having been long sovereigns of Italy. On the death of Francis Sforza, therefore, in 1536, Charles V. declared the Milanese to be an imperial fief, and granted the investiture of it to his son Philip II., king of Spain. In his family it continued till 1706, when the French and Spaniards were driven out by the Imperialists, and the emperor again took possession of it. It was confirmed to his house by the treaty of Baden in 1714, by the quadruple alliance in 1718, and by the treaty of Aix-la-Chapelle in 1748. But in June 1796 this country was overrun by the French under Buonaparte, and became an easy conquest. In 1797 it was revolutionized, and formed into several departments, as the Cisalpine republic. In April 1799 it was again overrun and reduced by the Austrians and Russians under Suwarrow: but, upon Buonaparte's return from Egypt, in was in 1800 once more reduced by the French; erected into the department of Olona, 13th of May 1801, and included in the Italian republic in December 1801, then in the kingdom of Italy, and finally restored to Austria as we have intimated.

MILAN, or MILANO, a very considerable and populous city of Italy, the capital of the Austrian Lombardo-Venetian kingdom, is nearly circular in its form, and extends to a circumference of nearly ten miles on the small river Olona: that is, the outer wall is of this extent, but it includes numerous gardens and plantations.

The streets are generally irregular and narrow, but the modern parts are in better taste, and the private houses, without having many pretensions to elegance, are tolerably built, and from three to five stories in height. Sumptuous family mansions occasionally appear, as in Rome and Genoa. The great entrance into the city is from the north-west, by the esplanade or arena, in the middle of which stands the Gothic castle of the family of Visconti. This arena, called the Piazza di Castello, was ornamented by prince Eugene Beauharnois, when viceroy of Italy, with plantations, grass plots, and gravel walks, and converted into a spacious garden; but the most popular public walk is the Corso, and the adjacent gardens, on the eastern side of the city. The fortifications are not of any available strength.

The cathedral is considered one of the finest Gothic churches in Europe. It is of fine white marble, and though begun in the sixteenth century, ages have passed over it and left it incomplete; 'the immense sums lavished upon it by wealthy sinners,' says a late traveller, 'to forward its continuation, seem to have retarded the work, by extending its plan. St. Charles Borromeo (the citizen saint of Lombardy) did much towards its completion; but, on his death, two centuries succeeded without hastening the progress of the erection, and the foundation of Galeazzo still remained unfinished, when a usurper like himself, influenced by the same motives and gifted with the same energies, at once completed it. Buonaparte is said to have contem

plated this temple, on his first arrival at Milan, with unsatiated delight; and to him it owes the fabrication of two-thirds of its splendid façade, a considerable number of its 400 statues, which rather incrust than decorate it, and the perfect condition in which it now strikes the eye with wonder and admiration.

'As we first saw it,' continues lady Morgan, 'in the radiance of the mid-day sun, its masses of white and polished marble, wrought into such elegant filigree as is traced on Indian ivory by Hindoo fingers, its slim and delicate pinnacles, tipped with sculptured saints, light as 'e'er danced on the point of a needle, or rode on the beams of the sun,' it looked (all gigantic as it is) like some fairy fabric of virgin silver; and left the eye dazzled, and the imagination fascinated. Its exterior lustre was strikingly contrasted with its interior solemnity; and, as we drew back the folds of the heavy drapery which shades the entrance of this as of all Italian churches, nothing could be more impressive than that long solemn sweep of nave, whose deep perspective fades and mellows as it recedes from the eye, and is finally almost lost in distance and obscurity. Before the high altar stands the shrine of St. Charles Borromeo, with its circle of burning lamps; the spacious choir rises behind it. The lateral aisles with their massive columns of red granite, and votive chapels, the porphyry baptismal font, the marble pavement, were tinged with the brilliant hues which fell through the high-arched and richly painted windows. A procession of the chapter, with their archbishop at their head, was issuing from the choir, and disappeared through a lateral door leading to the sacristy. Another less splendid but more solemn procession came forth from a chapel, announced by the ringing of a bell, the glare of torches, and accompanied by a guard of soldiers with fixed bayonets; it was the sacrament, borne on a velvet cushion, and under a superb canopy—the viaticum of some dying sinner.' It is 490 feet long, 298 broad, and 260 high. The façade is magnificent, and the three other sides hardly inferior. The roof is covered with slabs of marble; and above the dome there rises an elegant tower or spire, in the shape of an obelisk. All parts of the building are crowded with elegant marble statues, said to amount, inside and out, to the number of 4000. Here is a subterranean chapel, containing the body of Charles Borromeo, enclosed in a shrine of rock crystal. Several of the other churches, though far inferior to the cathedral, are worth attention, chiefly for the statues and paintings of celebrated masters which decorate them. The church of Laurentius has a Roman colonade of the Corinthian order, in marble of Paros.

When the emperor Joseph began those ecclesiastical reforms which the late republican government attempted to complete, tne ecclesiastical buildings of Milan occupied more than one-third of the city. There are still abundantly enough for all the purposes of religious worship.

The hospitals and other charitable institutions amount in all to about thirty. The Ospedale Maggiore is an immense edifice, capable of containing 1200 patients. It has a revenue of 100,000 rix-dollars. The foundling hospital receives about 4000 children. A lazaretto, outside of the city, is also on a vast scale, but is opened only for epidemics. 'In the refectory, or hall of the convent of the Dominicans,' says Mr. Eustace, 'was, as is well known, the celebrated Last Supper by Leonardo da Vinci, supposed to be his masterpiece. The convent was suppressed; and the hall turned into a store-room of artillery; and the picture was used as a target for the French soldiers to fire at. The heads were their favorite marks; and that of our Saviour, in preference to the others.' Lady Morgan, however, wholly contradicts this story; she saw the picture after Mr. Eustace, and could not trace the marks of a single shot, though the whole was in a decayed and faded state. 'The first object that meets the eye, on approaching this fresco,' she says, 'is a door cut through the legs of the principal figure, and that the figure of our Saviour!' The history of this door is well known at Milan. The dishes served at the monks' table were found to cool in passing along the cloisters; and it was decreed by the chapter that a communication should be opened from the refectory to the kitchen, which stood behind the picture of Leonardo. Thus the Last Supper was destroyed, that the abbot's dinner might be served hot! This anecdote, which might so well have served as a pendant for the 'target of the French soldiers,' Mr. Eustace has not mentioned, though, if he visited the picture, this door could not possibly escape him.

The Brera, or palace of the arts and sciences, has been dignified of late with the name of a University, for the education of young nobles. Under the recent government of the kingdom of Italy it changed its name to the Institute. Its revenues were augmented, its building (unfinished at the Revolution) was completed by the present government, and it was solemnly opened for public instruction, and for the service of the arts and sciences. Its schools are numerous: those for painting in all its branches, architecture, anatomy as applied to the arts, perspective, &c., being directed by native artists of great merit and celebrity. The school of engraving, under the admirable Longhi, is one of the first in Italy. The observatory, raised by the Jesuits in 1766, after a plan of Boscovich, is filled with the most expensive astronomical instruments, purchased in France, Germany, and England; among others a fine telescope by Herschel: the corridors with models of machinery, of ships, and other objects connected with the marine, &c. &c. The upper portico of this fine building contains a magnificent gallery, into which all that could be obtained or purchased of the ancient school of Lombardy is elegantly arranged: and the public library, where to the books left by the Jesuits were added the library of Pertusati, a part of that of Haller, and a small collection left by the cardinal Durini, together with a portion of the books collected from the suppressed convents. A sum was also assigned by the government for the purchase of new and valuable works, which sum was never permitted to accumulate. A few medals, once preserved, or neglected at the mint, were given to this institution, and formed the basis of a collection, which under the direction

of Signore Cataneo, one of the most learned numismatists in Europe, has grown to an extent almost unrivalled even in Italy.

Milan owes to the cardinal Frederic Borromeo her great and deservedly celebrated public library, the Bibliotheca Ambrosiana. The libraries of the Benedictines formed the nucleus of this collection, which has gradually extended to its present importance. The treasures of the collection are the MSS. of Leonardo da Vinci, called Codice Atlantico, from the size of the volume. They consist of a number of loose leaves, which Leonardo covered with sketches, notes, mathematical figures, and problems. Another celebrated MS. of the Ambrosian library is a Virgil, said to have been copied by Petrarch, in which he has traced some marginal annotations, and some lines on the death of Laura.

The church and the theatre are two of the principal engines with which the little governments of Italy have sustained their power. After the Duomo, there is no public building in Milan so attended, and so prized, as the theatre of the Scala. The ideas of pleasure and of devotion may indeed be here mingled in a truly Catholic manner; for it was on the ruins of the ancient church of Santa Maria della Scala that in 1778 this splendid theatre was built. The exterior is very handsome. 'The corps d'edifice is faced with arcades, which shelter the company, in descending from their carriages, from the inclemencies of the weather. Above these a broad terrace with a balustrade leads to the ridotto, or gaming rooms, which are under the protection of the government. Below, a very insignificant vestibule leads to the lower boxes and pit, whence staircases conduct to the upper circles. This theatre, which is said to be larger than the Opera house of London, has six circles of boxes, and a most spacious and well-arranged pit. Each circle has forty-six boxes. The imperial box, in the centre, is a superb open apartment, occupying the place of three boxes, and extending through three tiers in height. It is resplendent with gilding, and is surmounted with the imperial crown and cross. The proscenium is decorated with Corinthian columns, and the vaulted roof is richly painted in compartments by Pirego. In that part of the proscenium where, in England, is placed the king's escutcheon, there is here, as in the other theatres of Italy, a clock, whose dial with its transparent figures revolves before a strong light, to indicate the time to all parts of the house. The drapery of the boxes is uniform and rich; and great magnificence is displayed in their interior decoration, in hangings of silk and velvet cushions, with chandeliers (lighted at pleasure), and for the most part a small adjoining apartment for supper or play. All belonging to this establishment, except the corps dramatique, shows how material an object it is both to the government and people.

This is the evening home of almost all ranks, the recreation of the tradesmen, the exchange of the merchant, the closet of the critic, and the rendezvous of the politician. 'There alone,' says lady Morgan, 'amidst the openest publicity, can privacy find an asylum against the intrusions of espionage. The box is sacred—none can intrude there but the intimate friends of the lady or her husband: and the numerous 'arie di sorbetti' (dull pass of music) call for no attention even from musical enthusiasm; while with their accompaniments they drown the whispered conversation, whatever may be its tendency. Besides those whom pleasure or business, the performance or the rendezvous, bring to the Scala, it is frequented by another class, which under the new order of things daily increases through Italy. Its ranks, once so numerous, were supplied by the cadets of noble families, or of those who, shackled by birth, without opulence to enjoy, or business to occupy, lounge through life in indolent listlessness. In the evening these gros garçons are seen stuffed in their grandmothers' calashes at the Corso; at night they take their places, at stated times, in the boxes of such female friends as are good-natured enough to receive them. They are sure to arrive the first, and take their solitary seat in darkness and in silence. With the first coup d'archet, they fall into probationary stupor, from which they are only aroused by the arrival of the mistress of the box; when having bowed profoundly to her cordial ciavo, and kissed reverentially her graciously extended hands, they relapse into a doze, that resembles baron Trenck's sleep; for it is disturbed every ten minutes by successive visitors, to each of whom they are obliged to give up in turn their place; until at last, reaching the door, they make a profound bow and retire, to sleep out the rest of the evening in the successive boxes to which they have by prescription the entrée.'

There are three or four smaller theatres: but that of Girolamo della Crena alone disputes the popularity of the Scala. This is so called from the name of the principal puppets, who is a very powerful rival of the veteran Policinello. Whatever piece is represented upon this stage, Girolamo is always the principal actor. His distinctive character is, that he speaks Piedmontese, and makes stupid mistakes to please the inhabitants of Milan, and to feed their municipal prejudices against their neighbours; exactly as the Milanese Menichino performs for the amusement of the rest of the north of Italy, and as honest Pat is travestied on the London stage to flatter the cockney prejudices of John Bull. This species of wit is, in general, of tolerably cheap production, and it does not belong to very kindly dispositions; nevertheless Girolamo is sufficiently facetious, and, if his jokes are offensive to national vanity, after all, he is but a puppet. In 'Zemire ed Azore' (the piece we saw performed) Girolamo was the servant of the old merchant who gets into the enchanted palace, and he exhibits the usual quota of timidity that belongs to the servant of low comedy. He always addresses the beast by the appellation of 'mostro gentile,' or 'gentleman monster;' and, though more of action lay in his right leg than was strictly necessary for the development of the plot, yet some of his poetic flights were very ludicrous. His invocation to gloomy night, which he pronounced to be 'dark as a tailor's conscience,' is a fair specimen of his excellence in the anti-climax.' The people of fashion, at Milan go once in the season to Girolamo, as, at

Paris, the same class go to the Ambigu and the Gaieté, and it is thought good fun, once in a way; but the people find Girolamo good fun every night in the year, and rarely desert him.' The piazza del Duomo, we are told, also nightly exhibits *puppet-shows*, and the steps of the cathedral are crowded with an audience who have not the means of paying for a box at Girolamo's little theatre.

Of the ancient fortresses of Milan two antique towers alone remain. It is supposed that the castle erected by Galeazzo Visconti was begun in the year 1358. This having been demolished, a second was built by John Galeazzo: but, that also exciting the jealousy of the republican citizens, it became a sacrifice to the liberty of the country. Francis Sforza erected, for the third time, a fortification to overawe the people of Milan. Of this latter edifice the two towers just mentioned are a remnant. The rest of the building was levelled by the French; and a modern barrack occupies the site of the ancient keep. The remainder of the space was dedicated, by the late Italian government, to the amusement of the people; and was laid out into regular walks and grass-plats, with rows of trees, under the direction of Canonica, an architect of celebrity. This really elegant promenade was, at the epoch of its formation, called, in the language of that day, Forum Buonaparte; at present it is known under the more orthodox appellation of Place du Chateau.

At the point where the grand road over the Simplon terminates in the city of Milan, at the end of this promenade, a superb triumphal arch was commenced in Buonaparte's time, after the design of the marquis Luigi Cagnola. It is a work which, for magnitude and beauty, is well worthy the greater work whose successful termination it celebrates. But it is completed to scarcely more than one-third of its intended height. At the restoration the work was suspended, and the arch remains, as it was left in 1814, surrounded by masses of marble, as they were drawn from Carrara, and blocks of granite torn from the acclivities of the Simplon.

The Corso della Porta Orientale is particularly striking. Several new palaces, standing upon the site of demolished convents and churches, rise on either side. The façades are chiefly of the Greek order, and contrast forcibly with the massive, monastic fronts of the old buildings which are usually of Spanish architecture. On the left of this beautiful Corso is the public garden, which was but just finished at the restoration. It is separated from the street by a range of granite pillars, with a cornice surmounted by antique vases; and a light iron-railing, decorated with armorial bearings. The garden is cut into irregular alleys, diversified with trees and glass-plats, and watered by a canal. The buildings are in good keeping: they consist of an amphitheatre, a carousel or large pavilion, and an edifice in the centre for the public amusements. This temple of pleasure was, a few years back, a convent of nuns of a rigid order; and, if the spirit of some old lady abbess still visits the haunts of her power or penance, it must, all spirit as it may be, be struck with wonder. A flight of stairs leads from this garden to a public walk, which has been made and planted upon the ramparts, from the Porta della Tenaglia to the Porta Romana, a very considerable extent. The Villa Reale, a residence of the viceroy, adjoins, and adds considerably to the magnificence of the scene.

Lady Morgan notices, with enthusiasm, the Royal and Imperial Pensionat, a superb female seminary, founded by the late government. 'There, however,' she says, 'tameness and gentility, conventional grace and arbitrary elegance, were the prevailing characteristics. Of all the benefits which the revolution has conferred upon Italy, the greatest, the most permanent, is the new and liberal system of female education, raised upon the ruins of that demoralising bigotry which was calculated to make women concubines and devotees, but which could not produce good wives and good mothers. In most of the great capitals Buonaparte, or the Italian governments that acted under his influence, have formed establishments for the education of girls of all ranks, and endowed them with sufficient revenues; being fully aware how powerfully women contribute in determining the character of society; and how much a generation of well-educated females must contribute to raise it from that gulf of immorality into which the vices and feebleness of the old governments had plunged this part of Europe. The church, convent, and grounds of San Filippo Neri, belonging to an order of nuns, with a considerable revenue, were appropriated by the government to this establishment, intended as a national school for females, and more particularly for the orphan daughters of the officers of the army who fell in the service. It is a fact that, when this seminary was established, no Italian lady, fitted by education or experience, could be found, who was willing to accept the place of its directress; and the baroness de Lor, a lady of distinguished talent and irreproachable conduct, was taken from a similar establishment near Paris, to superintend the foundation at Milan.

'In our visit to this seminary we were accompanied by Madame de Lor herself; a lady whose society we afterwards sought upon all occasions with pleasure, and enjoyed with profit. As there is no English school of this description, no comparison can be drawn; but in the great points of air, space, elegance, and accommodation, neatness, freshness, and good order, it is impossible that it should be exceeded. The convent of St. Philip Neri resembles a royal palace: its arcades below, and its open galleries above, surround a beautiful and well cultivated garden. The dormitories are spacious, and provided with dressing-rooms abundantly supplied with water in superb fountains. There are also warmed apartments (scaldatorj), in which the children are permitted to amuse themselves before they retire to rest. The rooms are lighted at night by pending lamps, which are enclosed in glass bells, and burn till day-light, no candles being allowed. The hospital bed-rooms are on the upper story, and are attended by two nuns, sœurs de la charité: there are warm and cold baths adjoining. The wardrobe is a vast apart-

ment, filled with every article of female dress, made by the children themselves for their own use; the materials being found by the establishment. Another room is appropriated to works of ornament. There are also separate apartments for each class, all opening into the garden; by which the disadvantage of a close and heated atmosphere, so common even in our own best schools, is effectually avoided. We saw groups of little children hurrying from one class to another through blooming shrubs and orange trees, each with her little straw bonnet and basket on her arm. We afterwards saw them assembled in a vast and handsome hall, from whence they proceeded to an excellent dinner. When Madame de Lor entered several of the little ones clung around her, and each had her nom de caresse, or some mark of affection and familiarity. She addressed them all in French, to show us the progress they had made, and made them laugh heartily at their own mistakes. Italian is much cultivated; Milanese is rarely allowed. Their studies are liberal, and must shock many of their noble grandmothers, who scarcely learned to read and write; and who see their illustrious descendants (condemned by their birth to worthlessness and indolence) thus occupied in cutting out shifts, making stays, inventing dresses, and mending stockings, conversant in all the details of which no mother or mistress of a family should be ignorant, and combining these homely duties with languages, the arts, the sciences, and literature!'

As lately as 1743 a French traveller describes the archbishop's palace and the governor's house of Milan as the only residences in the city where the windows were completely glazed. Glass was then quite a distinction, as it still is in the villages about Rome and Naples; and some of the handsomest edifices in Lombardy had their windows covered with oiled paper. Glazing is now, however, general: though, amidst many great and beneficial changes introduced into Milan, much remains to be done: while the higher arts, for instance, have been well attended to, the art by which a door is hinged, or a window closed, is still in its infancy.

The trade of this city is not extensive, being chiefly confined to the import of its manufactory, consisting of silk stuffs, ribands, printed cottons, leather, paper, earthenware, and most beautiful porcelain. There is a considerable manufacture of tobacco and snuff also carried on on account of government. The carrying trade is favored by the two canals which connect it with the Adda on the one side, and the Ticino on the other.

Since 1800 the population of Milan has been in a state of progression. In 1805 it was estimated at 120,000; in 1806 at 125,000; in 1808 at 129,000; and in 1820 at 140,000. It is seventy-five miles E. N. E. of Turin; 145 north-west of Florence; and 280 north-west by north of Rome.

MILBORN PORT, a post town of Somersetshire, seated on a branch of the Parrat, 117 miles from London. It formerly sent two representatives to parliament, but is neither a market-town nor a corporation; but it appears in Domesday book to have once had a market, and fifty-six burgesses. It is surrounded by Dorsetshire. Here are nine capital burgesses, who yearly choose two bailiffs, that have the government of the borough under them, and jointly returned members to parliament with the two stewards, who are chosen yearly out of nine commonalty stewards, and have the custody of the corporation seal. These two stewards also distribute the profits of the lands given to the poor here, of which the commonalty stewards are trustees. There are two fairs, June 6th and October 28th. This ancient borough was disfranchised by the Reform Bill.

MILBOURNE (Luke), was the son of a nonjuring divine of that name, who was ejected from his living of Wroxhall in Warwickshire, where the subject of this article was born in 1667. He received his education at Pembroke Hall, Cambridge, when he took the degree of A. M., and, entering the church, obtained the rectory of St. Ethelburga, and the lectureship of St. Leonard's Shoreditch, London. He published Remarks on Dryden's Translation of the Æneis, which Johnson speaks of contemptuously. His name has also been introduced by Pope in the Dunciad. The remainder of his writings consist of a Version of the Psalms, and about thirty sermons. He died in 1720.

MILBURY, a post town of Worcester county, Massachusetts, six miles south of Worcester. This town has been formed of a part of Sutton since the last census, and is watered by Blackstone river. It contains a woollen manufactory, a saw mill, an iron manufactory, a rolling and slitting mill, a nail manufactory, six scythe shops, a gun manufactory employing forty or forty-five workmen, extensive tanneries, and paper and oil mills.

MILCH, *adj.* From MILK, which see. Yielding milk.

And then he blasts the tree, and takes the cattle
And makes *milch* kine yield blood. *Shakspeare.*

The best mixtures of water in ponds for cattle, to make them more *milch*, fatten, or keep them from murrain, may be chalk and nitre. *Bacon.*

Not above fifty-one have been starved, excepting infants at nurse, caused rather by carelessness and infirmity of the *milch* women. *Graunt.*

With the turnips they feed sheep, *milch*-cows, or fatting cattle. *Mortimer's Husbandry.*

MILD, *adj.*
MILD'LY, *adv.*
MILD'NESS, *n. s.*
} Sax. milꝺ; Goth. and Teut. *mild*; Swed. *milder*. Soft; tender; lenitive; not sharp or acrid: hence gentle; kind; tender; merciful; indulgent: the adverb and substantive corresponding.

Be not full of chidyng, but temporat, schewyng all *myldenesse* to all men. *Wiclif. Tyte.* iii.

This milky gentleness and course of yours;
You are much more at task for want of wisdom,
Than praised for harmful *mildness*. *Shakspeare.*

The execution of justice is committed to his judges, which is the severer part; but the *milder* part, which is mercy, is wholly left in the king.
Bacon's Advice to Villiers.

The air once heated maketh the flame burn more *mildly*, and so helpeth the continuance.
Id. Natural History.

The Irish were transplanted from the woods and mountains into the plains, that, like fruit trees, they

might grow the *milder*, and bear the better and sweeter fruit. *Davies.*

The rosy morn resigns her light,
And *milder* glory, to the noon. *Waller.*

Nothing reserved or sullen was to see,
But sweet regards, and pleasing sanctity;
Mild was his accent, and his actions free. *Dryden.*

Prince, too *mildly* reigning,
Cease thy sorrow and complaining. *Id.*

The same majestic *mildness* held its place;
Nor lost the monarch in his dying face. *Id.*

The folding gates diffused a silver light,
And with a *milder* gleam refreshed the sight. *Addison.*

His probity and *mildness* shows,
His care of friends and scorn of foes. *Id.*

Suppose your eyes sent equal rays
Upon two distant pots of ale,
Not knowing which was *mild* or stale. *Prior.*

It teaches us to adore him as a *mild* and merciful being, of infinite love to his creatures. *Rogers.*

Their qualities are changed by rendering them acrimonious or *mild*. *Arbuthnot on Aliments.*

Sylvia's like autumn ripe, yet *mild* as May,
More bright than noon, yet fresh as early day. *Pope.*

MILDEW, *n. s.* Sax. mıldeape; Teut. *millow*, i. ros *melleus*.—Minsheu. A disease or blight in plants, accompanied by a dewy moisture.

Here is your husband, like a *mildewed* ear,
Blasting his wholesome brother. *Shakspeare. Hamlet.*

The *mildew* cometh by closeness of air; and therefore in hills, or champaign grounds, it seldom cometh. *Bacon.*

Down fell the *mildew* of his sugared words. *Fairfax.*

Soon blasting *mildews* blackened all the grain. *Dryden.*

Morals snatch from Plutarch's tattered page,
A *mildewed* Bacon, or Stagyra's sage. *Gay's Trivia.*

Mildew is a disease of plants, caused by a dewy moisture which falls on them, and continuing, for want of the sun's heat to draw it up by its acrimony, corrodes, gnaws, and spoils the plant: or *mildew* is rather a concrete substance, which exudes through the pores of the leaves. *Hill.*

MILDEW, in agriculture, a disease frequently destructive to corn, pulse, and garden-crops. It is occasioned, says Hill, by a dewy moisture which falls on them, and continuing, for want of the sun's heat to draw it up, by its acrimony corrodes, and destroys the plant. Others say that mildew is a thick clammy vapor exhaled in the spring and summer from the plants, blossoms, and even the earth itself, in close, still weather, where there is neither sun nor wind. Miller thinks the true cause of the mildew appearing most upon plants which are exposed to the east, is a dry temperature in the air when the wind blows from that point, which stops the pores of the plants, and prevents their perspiration; whereby the juices of the plants are concreted upon the surface of their leaves, which, being of a sweetish nature, insects are enticed thereto. It sometimes rests on the leaves of trees in form of a fatty juice, and sometimes on the ears of corn. It is naturally very tough and viscous, and becomes still more so by the sun's heat exhaling its more fluid parts; by which means the young ears of corn are so daubed over, that they can never arrive at their full growth. Bearded wheat is less subject to the mildew than the common sort; and it is observed that newly dunged lands are most liable to mildew. The best remedy is a smart shower of rain, and immediately afterwards a brisk wind. If the mildew is seen before the sun has much power, it has been recommended to send two men into the field with a long cord, each holding one end; and, drawing this along the field through the ears, the dew will be dislodged from them before the heat of the sun is able to dry it to that viscous state in which it does the mischief. Some also say, that lands which have for many years been subject to mildews, have been cured of it by sowing soot along with the corn, or immediately after it. Mr. J. S. Sagar, the author of a treatise upon this subject, observes, that the mildew is of such a sharp corrosive nature, that it raises blisters on the feet of the shepherds who go barefoot, and even consumes the hoofs of the cattle. He considers the mildew as a principal cause of epidemical distempers among the cattle. The mildew producing these diseases, he says, is that which dries and burns the grass and leaves. It falls usually in the morning, particularly after a thunder-storm. Its poisonous quality (which does not continue above twenty-four hours) never operates but when it has been swallowed immediately after its falling. The disorder attacks the stomach, is accompanied with pimples on the tongue, loss of appetite, a desiccation of the aliments on the stomach, a cough, and difficulty of respiration. See RURAL ECONOMY.

MILE, *n. s.* } Fr. *mille*; Ital. *miglio*; Lat.
MILE'-STONE, } *mille* (a thousand paces). An English road measure of 1760 yards: milestone, the stone set to mark each mile.

We must measure twenty *miles* to-day. *Shakspeare.*

Within this three *mile* may you see it coming,
A moving grove. *Id. Macbeth.*

When the enemy appeared, the foot and artillery were four *miles* behind. *Clarendon.*

Millions of *miles*, so rapid is their race,
To cheer the earth they in few moments pass. *Blackmore.*

A MILE is a measure of length or distance containing eight furlongs. The English statute mile is eighty chains. Three miles make one league (see LEAGUE); but it varies in different countries. See WEIGHTS and MEASURES.

MILETUS, in ancient geography, a town of Crete, mentioned by Homer. It is said to be the mother town of Miletus in Caria, whither a colony was led by Sarpedon, the brother of Minos. Ephorus, quoted by Strabo.

MILETUS, in ancient geography, a celebrated town of Asia Minor, on the confines of Ionia and Caria. It was the capital city of Ionia, and famous both for the arts of war and peace. It was situated about ten stadia south of the mouth of the Mæander, near the sea-coast. It was founded by a Cretan colony under Miletus, the companion of Bacchus; or, according to others, by Nileus the son of Codrus; or by Sarpedon a son of Jupiter. It has successively been

called Lelegeis, Pithyusa, and Anactoria. The Milesii were very powerful, and long maintained an obstinate war against the kings of Lydia. They early applied themselves to navigation; and planted no less than eighty colonies, or, according to Seneca, 380, in different parts of the world. It was taken by Alexander with much difficulty. It gave birth to Thales, Anaximander, Anaximenes, and other great men. According to Virgil, it was noted for its excellent wool, and for a temple and oracle of Apollo Didymæus. In this town St. Paul preached his farewell sermon to the elders of Ephesus. See Acts xx. 18—35. It is now called by the Turks Melas.

MIL'FOIL, *n. s.* Lat. *millefolium.* Yarrow.

Milfoil and honey-suckles pound,
With these alluring savors strew the ground.
Dryden.

MILFOIL, or YARROW. See ACHILLEA.

MILFORD, a town of Hillsborough county, New Hampshire, on the Sowhegan; two miles south-west of Amherst, and forty-eight north-west of Boston. Population 1117. It is a pleasant town, and contains two cotton manufactories, and two houses of public worship, one for Congregationalists, and one for Baptists.

MILFORD HAVEN, one of the first harbours in Europe, and indisputably the best in Britain, is situated in Pembrokeshire in South Wales, and lies on the north side of the Bristol Channel. It is very large, safe, and deep; there is no danger of going in or out with the tide, or almost with any wind. If a ship comes in without a cable or anchor, she may run ashore on the ooze, and there lie safe till she is refitted; and in an hour she may get out of the harbour into the open sea. It is very convenient for ships bound from the English or Bristol Channels to Ireland, or farther west, and 1000 sail of any size may ride secure in it. It has sixteen deep and safe creeks, five bays, and thirteen roads. The spring tide rises thirty-six feet; so that ships may at any time be laid ashore. Dale harbour is a ready outlet for small vessels, where they may ride in two or three fathoms at low-water. In the reign of queen Elizabeth, before the Spanish invasion, two forts were begun at the entrance of Milford Haven, one on each side, called Nangle and Dale blockhouses; but they were not then finished.—The stack rock rises here above water, near the middle of the entrance between Nangle and Dale. Penermouth is the opening of that branch of the haven on which Pembroke is seated, and where the custom-house of Milford is kept. The breadth of the entrance between rock and rock is but 200 yards at high-water, and 112 at low-water. There is a ridge of rocky ground named Carrs, which runs almost across Milford Haven, from Peter church toward Llanstadwell, where it renders the landing-place difficult to strangers, from its not appearing at low water. As this harbour lies near the mouth of the Severn, a ship in eight or ten hours may be over on the coast of Ireland, or off the Land's End in the English Channel; and a vessel may get out hence to the west much sooner than from either Plymouth or Falmouth. This harbour has been greatly improved by new works, at the expense of government. The parliament in 1759 granted £10,000 for fortifying the harbour of Milford, all of which was expended on the fort of Neyland, which, however, still remains unfinished. A quay and several new buildings have lately been erected by a society of Quakers, who have established themselves here from America. It has a commodious custom-house at the lower end of the town, which is independent of that of Pembroke, but the trade of the port is at present inconsiderable. This place has lately been established as one of his majesty's principal dock-yards for ship-building.

MILHAU, a town of France, in the department of the Aveyron, on the Tarn. Its manufactures are of gloves, hats, and leather. Population 6100: twenty-seven miles south-west of Rhodez.

MILHAUD, or MILLAU, a very ancient town, the chief place of a sub-prefecture of the same name, in the department of the Aveyron in France, having an inferior court, a chamber of commerce, an agricultural society, and a communal college. It is a post-town, containing 6000 inhabitants. It stands in a fine valley on the right bank of the Tarn, a little below the spot where it joins the Gambie, and is surrounded by hills planted with peach and almond trees; the houses are well built; the streets, though narrow, are well ventilated, and adorned with several public fountains; there is also a very pretty square, and some pleasant walks. This town was known in the time of Julius Cæsar by the name of Æmilianum; it was once fortified, and became one of the strongest places in the possession of the Calvinists: Louis XIII. however, having carried it by assault in the year 1629, caused its fortifications to be demolished. Manufactures are carried on here of cloth, serge, gloves, and chamois, white and other leathers; the inhabitants also trade in wool (raw and spun), leather, building wood, staves, cheese, wine, almonds, cattle, &c. It is the native place of general Solignac; and is forty-two miles south-east of Rhodez, twenty-one north-east of St. Affrique, fifty-four south-west of Florac, and 456 S. S. E. of Paris.

MILIARENSIS, in antiquity, a silver coin of the empire, substituted by Constantine the Great in the room of the denarius; and so called because he fixed the price of the pound of gold at 1000 pieces of this new silver. But as he divided the pound of gold also into seventy-two solidi, each solidus really contained 13⅞ miliarenses, though it passed for fourteen; which difference between the real and current value of the solidus, in relation to the miliarenses, must have occasioned disputes in the payment of small sums. To remedy this inconvenience, it was thought proper to alter the weight of the silver money, and, having fixed the price of the pound of silver at five solidi, to coin sixty pieces out of it, which retained the name miliarenses, though the pound of gold was worth but 864. It does not appear how many miliarenses Constantine coined out of the pound of silver; but, if the piece of gold was nearly the same in his reign as when five solidi were worth a pound of silver, the pound must have been worth 14⅖ pounds

of silver; and 1000 divided by 14⅜ gives 69⅝ for the number of miliarenses coined out of the pound. Therefore it is probable that Constantine's number was either sixty-nine or seventy.

MIL'IARY, *adj.* Fr. *miliaire;* Lat. *milium* (millet). Small; resembling millet: applied medically to small eruptions.

The scarf-skin is composed of small scales, between which the excretory ducts of the *miliary* glands open. *Cheyne.*

MILIARY FEVER. See MIDWIFERY.

MILI'CE, *n. s.* Fr. *milice.* Standing force. A word, says Dr. Johnson, innovated by Temple, but unworthy of reception.

The two-and-twentieth of the prince's age is the time assigned by their constitutions for his entering upon the public charges of their *milice.* *Temple.*

MIL'ITANT, *adj.* Fr. *militante;* Lat. *militans.* Warlike; fighting; often applied to the spiritual warfare of the Christian church.

Against foul fiends they aid us *militant;*
They for us fight; they watch and duly ward,
And their bright squadrons round about us plant. *Spenser.*

Then are the public duties of religion best ordered, when the *militant* church doth resemble, by sensible means, that hidden dignity and glory wherewith the church triumphant in heaven is beautified. *Hooker.*

The state of a Christian in this world is frequently compared to a warfare: and this allusion has appeared so just, that the character of *militant* has obtained as the common distinction of that part of Christ's church sojourning here in this world, from that part of the family at rest. *Rogers.*

MIL'ITAR, *adj.* } Fr. *militaire;* Lat. *mili-*
MIL'ITARY. } *taris.* Warlike; engaged as a soldier; soldierly. Militar is now wholly out of use.

In the time of Severus and Antoninus, many, being soldiers, had been converted unto Christ, and notwithstanding continued still in the *military* course of life. *Hooker.*

He will maintain his argument as well as any *military* man in the world. *Shakspeare. Henry V.*

Although he were a prince in *militar* virtue approved, yet his cruelties weighed down his virtues. *Bacon's Henry VII.*

He was with general applause, and great cries of joy, in a kind of *militar* election or recognition, saluted king. *Bacon.*

Numbers numberless
The city gates out-poured, light-armed troops
In coats of mail and military pride. *Milton.*

The wreathes his grandsire knew to reap
By active toil, and *military* sweat,
Pining incline their sickly leaves. *Prior.*

MILITARY AFFAIRS. In the time of the Anglo-Saxons the military force of England was in the hands of the dukes or heretochs, who were constituted through every province and county in the kingdom; being chosen out of the principal nobility, and such as were most remarkable for being sapientes, fideles, et animosi. Their duty was to lead and regulate the English armies, with a very unlimited power; prout eis visum fuerit, ad honorem coronæ et utilitatem regni. And they were elected by the people in their full assembly, or folkmote, in the same manner as sheriffs were elected; following that old fundamental maxim of the Saxon constitution, that where any officer was entrusted with such power as, if abused, might tend to the oppression of the people, that power was delegated to him by the vote of the people themselves. The ancient Germans, the ancestors of the Saxons, had also their dukes, as well as kings, with an independent power over the military, as the kings had over the civil state. The dukes were elective, the kings hereditary, as appears from Tacitus. In electing their kings the blood-royal was regarded; in choosing their dukes or leaders warlike merit; as Cæsar relates of them, in his time, that whenever they went to war they elected leaders to command them. This large share of power thus conferred by the people, though intended to preserve the liberty of the subject, was detrimental to the prerogative of the crown; and Edric, duke of Mercia, in the reign of Edmund Ironside, who by his office of heretoch was entitled to a large command in the king's army, by his repeated treacheries at last transferred the crown to Canute the Dane. It is agreed by all historians that king Alfred first settled a national force in England, and by his prudent discipline made all his subjects soldiers: but we are uninformed as to the particulars of his celebrated regulation; though the dukes seem to have been left in possession of too large a power, which enabled duke Harold, on the death of Edward the Confessor, though not of the royal blood, to mount the throne in prejudice of Edgar Atheling the rightful heir. Upon the Norman conquest the feudal law was introduced in all its rigor, and all the lands in the kingdom were divided into above 60,000 knight's fees; and for every knight's fee a knight or soldier, miles, was bound to attend the king in his wars for forty days in a year; in which time, before war was reduced to a science, the campaign was generally finished, and a kingdom either conquered or victorious. By these means the king had, without expense, an army of 60,000 men always at his command. And accordingly we find a law of William I. which enjoins the personal attendance of all knights and others; quod habeant et teneant se semper in armis et equis, ut decet et oportet, &c. This personal service in time degenerated into pecuniary commutations or aids; and at last the military part of the feudal system was abolished at the restoration. In the meantime, however, the kingdom was not left without defence, in case of insurrections or invasions Besides those who by their military tenures were bound to perform forty days' service in the field. And now arose the coincidence between these tenures and our early militia laws; the progress of which will be given in the following article.

When the nation was engaged in war, more veteran troops and more regular discipline were esteemed necessary, than could be expected from a mere militia; and therefore at such times more rigorous methods were adopted for raising armies, and for the due regulation and discipline of the soldiery. Martial law, Sir M. Hale observes, which is built upon no settled principles, but is entirely arbitrary in its decisions, is in truth no law, but something indulged rather than allowed as a law. The necessity of order and discipline in an army is the only thing which can give it

countenance; and therefore it ought not to be permitted in time of peace, when the king's courts are open for all persons to receive justice according to the laws of the land. Wherefore, Thomas earl of Lancaster being convicted at Pontefract 15 Edw. II. by martial law, his attainder was reversed, 1 Edw. III., because it was done in time of peace. And it is laid down, that if a lieutenant, or other that hath commission of martial authority, doth in time of peace execute any man by color of martial law, this is murder; for it is against magna charta. The petition of right enacts that no soldier shall be quartered on the subject without his own consent; and that no commission shall issue to proceed within this land according to martial. And whereas, after the Restoration, king Charles II. kept up about 5000 regular troops, by his own authority, for guards and garrisons, which James II. by degrees increased to no less than 30,000, all paid from his own civil list; it was made one of the articles of the bill of rights that the raising or keeping a standing army within the kingdom in time of peace, unless with consent of parliament, is against law. But as the keeping of standing armies (first introduced by Charles VII. in France, 1445) has of late universally prevailed over Europe, it has also for many years past been annually judged necessary by our legislature, for the safety of the kingdom, and the defence of the possessions of the crown of Great Britain, to maintain in time of peace a standing body of troops, under the command of the crown; who are, however, ipso facto disbanded at the expiration of every year, unless continued by parliament. To keep this body of troops in order, an annual act of parliament passes, called the Mutiny Act, 'To punish mutiny and desertion, and for the better payment of the army and their quarters.' This regulates the manner in which they are to be dispersed among the several inn-keepers and victuallers throughout the kingdom: and establishes a law martial for their government. By this it is enacted that if any officer or soldier shall excite, or join any mutiny, or, knowing of it, shall not give notice to the commanding officer, or shall desert, or list in any other regiment, or sleep upon his post, or leave it before he is relieved, or hold correspondence with a rebel or enemy, or strike or use violence to his superior officer, or shall disobey his lawful commands; such offender shall suffer such punishment as a court-martial shall inflict, though it extend to death itself. However expedient the most strict regulations may be in time of actual war, yet, in times of profound peace, a little relaxation of military rigor would not be productive of much inconvenience. And, upon this principle, though, by our standing laws, desertion in time of war is felony without benefit of clergy, and the offence is triable by a jury, and before the judges of the common law, yet, by our militia laws, a much lighter punishment is inflicted for desertion in time of peace. But any of the faults above mentioned are, equally at all times, punishable with death itself, if a court martial shall think proper. This discretionary power of the court martial is indeed to be guided by the directions of the crown, which, with regard to military offences, has almost an absolute legislative power. 'His majesty,' says the act, 'may form articles of war and constitute courts-martial, with power to try any crime by such articles, and inflict such penalties as the articles direct.' A vast and most important trust! an unlimited power to create crimes, and to annex to them any punishment not extending to life or limb! These are indeed forbidden to be inflicted, except for crimes declared to be so punishable by this act. But as soldiers, by this annual act, are thus put in a worse condition than other subjects; so, by the humanity of our standing laws, they are in some cases put in a better. By stat. 43 Eliz. c. 3, a weekly allowance is to be raised in every county for the relief of soldiers that are sick, hurt, and maimed: besides the benefit of the royal hospital at Chelsea, for such as are worn out in their duty. Officers and soldiers, that have been in the king's service, are by several statutes entitled to use any trade or occupation they are fit for, in any town in the kingdom, except the two universities. And soldiers in actual military service may make nuncupative wills, and dispose of their goods, wages, and other personal chattels, without those forms, solemnities, and expenses, which the law requires in other cases. See War.

Military Exercise. See Exercise and Manual.

Military Manœuvres. The military manœuvres of our army might historically include all the triumphs of the British arms. But they are taken technically for the entire detail of the exercise and movements of the military body; and in this we understand very decided improvements are in agitation at the War Office. Our informant adds that the new book of Regulations may be expected to be issued monthly: we shall therefore refer the reader for a brief account of its contents, and a comparison of the ancient and modern manœuvres, to the article War.

Military Tenures. See Feudal System and Tenure.

Military Ways, viæ militares, are the large Roman roads which Agrippa procured to be made through the empire, in the time of Augustus, for the more convenient marching of troops and conveyance of carriages. N. Bergier has written the history of these military roads, which were paved from the gates of Rome to the extreme parts of the empire.

MILITES, adscriptitii, supernumerary, men that followed the Roman armies for the purpose of filling up any vacancies which might occur through death or sickness. No particular duties were exacted from them, except that of marching in front of the troops, in order to annoy the enemy with their cross-bows.

Milites Causarii, among the Romans, soldiers who were discharged on account of sickness, and inability to serve, or from some other cause.

Milites Consummati, soldiers among the Romans who had served their prescribed period. They were also called emeriti.

Milites Mercenarii, auxiliary troops, or soldiers, who were hired by the Romans in the

time of war. Hence men hired to fight are called mercenaries.

Milites Provinciales, troops which composed the Roman legions, and consisted wholly of Romish citizens. The auxiliary troops were originally drawn out of the Italian provinces, that were in alliance with Rome; and, when they afterwards became Roman citizens, soldiers were enlisted and paid from other countries. Thus, before Barbary fell under the Roman yoke, large levies were obtained from that quarter of the globe.

Milites Stationarii, bodies of armed men, among the Romans, who were distributed through the empire, in order to check disorders, prevent plunder, and so escort the guilty to the tribunals of justices.

Milites Subitarii, troops raised upon emergency, especially on the breaking out of unexpceted hostilities. On these occasions men of all ages were obliged to enrol themselves.

Milites Urbani, a class of Roman soldiers, or rather an armed portion of the inhabitants of Rome, which remained in the capital, without any particular mark of distinction among themselves, in order to protect it during the absence of the regular troops, on the sudden commencement of hostilities. During the reign of the emperors, these men became the janissaries of Rome, for they insensibly grew into so much importance that they yielded in rank and consideration, as a body, to the prætorian bands only. They had regular camps in the city, which were called castra urbana. They were in high favor with the emperors, and generally shared a large proportion of the legacies which were left by the former in their wills. The privates received half the pay and subsistence which were allowed the prætorian bands; enjoyed exclusive privileges, and could only be commanded by the prefect of Rome.

The French, in imitation of the Romans, have called the different bodies of armed men oelonging to the several towns and districts, troupes urbanes, urban troops.

MILIT'IA, *n. s.* Lat. *militia*. The trainbands; a standing military force.

Let any prince think soberly of his forces, except his *militia* be good and valiant soldiers. *Bacon.*

The *militia* was so settled by law, that a sudden army could be drawn together. *Clarendon.*

Unnumbered spirits round thee fly,
The light *militia* of the lower sky. *Pope.*

Thus nature's refuse, and the dregs of men,
Compose the black *militia* of the pen. *Young.*

The Militia, or standing national force of this country, is traced by most historians to king Alfred, who by his prudent discipline made all the subjects of his dominions soldiers.

The feudal military tenures soon became involved in this force: they were established for the purpose of protection, and sometimes of attack, against foreign enemies; while for the further defence, in cases of domestic insurrections or foreign invasions, various other plans have been adopted, all of them tending to unite the character of a citizen and soldier. The legal authorities thus class them:—First the assise of arms, enacted 27 H. II., aud afterwards the statute of Winchester, 13 Ed. I. c. 6, obliged every man, according to his state and degree, to provide a certain quantity of such arms as were then in use; and it was part of the duty of constables under the latter statute to see such arms provided. These weapons were changed by stats. 4 and 5, P. & M. c. 2, into more modern ones; but both these provisions were repealed by stats. 1 Jac. 1, c. 25; 21 Jac. 1, c. 28. It was now usual, from time to time, for our princes to issue commissions of array; the form of the commission was settled anno 5 Hen. IV., so as to prevent the insertion therein of any new penal clauses. Rushw. pt. 3, p. 662, 667. See 8 Rep. 375, &c. But it was also provided, by stats. 1 E. III. stat. 2, c. 5, 7, and 25 E. III. stat. 5, c. 8, that no man should be compelled to go out of the kingdom at any rate, nor out of his shire but in cases of urgent necessity; nor should provide soldiers unless by consent of parliament. We first find lord-lieutenants of counties mentioned as known officers in the stat. 4 and 5 P. & M. c. 3, though they had then not been long in use; for Camden speaks of them, in the time of queen Elizabeth, as extraordinary magistrates constituted in times of difficulty and danger. But the introduction of these commissions of lieutenancy, which contained in substance the same powers as the old commissions of array, caused the latter to fall into disuse. Thus things continued till the repeal of the statutes of armour in the reign of king James I.; after which, when king Charles I. had, during his northern expeditions, issued commissions of lieutenancy, and exerted some military powers which, having been long exercised, were thought to belong to the crown, it became a question in the long parliament how far the power of the militia did inherently reside in the king; being now unsupported by any statute, and founded only upon immemorial usage. This question, long agitated with great heat and resentment on both sides, became at length the immediate cause of the fatal rupture between the king and his parliament: the two houses not only denying this prerogative of the crown, the legality of which might perhaps be somewhat doubtful, but also seizing into their own hands the entire power of the militia, of the illegality of which step there could never be any doubt at all.

After the Restoration, when the military tenures were abolished, it was thought proper to ascertain the power of the militia, to recognise the sole right of the crown to govern and command them, and to put the whole into a more regular method of military subordination. And the order in which the militia now stands by law is principally built upon the statutes 13 Car. II c. 6; 14 Car. II. c. 3; 15 Car. II. c. 4; which were then enacted. It is true the two last of them are apparently repealed: but many of their provisions are re-enacted, with the addition of some new regulations, by subsequent militia laws; the general scheme of which is to discipline a certain number of the inhabitants of every county, chosen by lot, formerly for three, but now for five years (liable to be prolonged by the circumstance of the militia being called out and embodied), and officered by the lord-lieute-

nant, the deputy lieutenants, and other principal landholders, under a commission from the crown. They are not compellable to march out of their counties unless in case of invasion or actual rebellion within the realm (or any of his majesty's dominions or territories, stat. 16 Geo. III. c. 3), nor in any case compellable to march out of the kingdom. They are to be exercised at stated times; and their discipline in general is liberal and easy; but, when drawn out into actual service, they are subject to the rigors of the martial law, as necessary to keep them in order. This is the constitutional security which our laws have provided for the public peace, and for protecting the realm against foreign or domestic violence. See 1 Comm. 410, &c.

The last general acts, reducing into one all the laws relating to the militia, are 42 Geo. III. c. 90 for England, and c. 91 for Scotland; these ascertain the particular quota to be raised in each county and district: but which has, from time to time, been augmented and altered by subsequent acts. It is provided that, in cases of actual invasion or imminent danger thereof, and in cases of rebellion and insurrection, his majesty may embody and increase the militia: and, if parliament is not then sitting, they are to meet by proclamation in fourteen days. The militia of Ireland is regulated on principles nearly similar, by stat. 49 Geo. III. c. 120, amended by 53 Geo. III. c. 48; 54 Geo. III. c. 179, &c. The interchange of the British and Irish militia, so that each may serve in any part of the united kingdom, is allowed and regulated under stats. 51 Geo. III. c. 118, 128; 54 Geo. III. c. 10 (a temporary act).

The wives and families of militia men are provided for, when requiring parish relief, under the acts 43 Geo. III. c. 47 for England; 43 Geo. III. c. 89 for Scotland; and 51 Geo. III. c. 78, 52 Geo. III. c. 28 for Ireland. The pay and clothing of all the militia is provided for by annual acts.

The militia having, under various temporary acts, volunteered into the regular army, from time to time, and being at length considered as peculiarly applicable to that purpose, it was found expedient 'that a local militia should be established, trained, and permanently maintained, to be called forth and employed in case of invasion in aid of the regular forces for the defence of the realm.' This was accordingly effected, first as to England by 48 Geo. III. c. 111, and afterwards for Scotland by 48 Geo. III. c. 150. These acts are amended by several subsequent ones; but the system has never been extended to Ireland.

The militia of the city of London is regulated by stats. 36 Geo. III. c. 92, and 39 Geo. III. c. 82; and that of the Tower Hamlets by 37 Geo. III. c. 25, 75, 53 Geo. III. c. 132.

With respect to the militia of the cinque ports see 42 Geo. III. c. 90, § 155, referring to 13 and 14 Car. II. c. 2 and 15 Car. II. c. 4. See also 43 Geo. III. c. 100.

MILIUM, millet, in botany, a genus of the digynia order, and triandria class of plants; natural order fourth, gramina: CAL. bivalved, and uniflorous: COR. very short; stigmata pencil-like. There are eight species; of which the most remarkable is the

M. panicum, common millet, a native of India, but now commonly cultivated in many parts of Europe as an esculent grain. It rises, with a reed-like stalk, three or four feet high, and channelled: at every joint there is one reed-like leaf, which is joined on the top of the sheath, and embraces and covers that joint of the stalk below the leaf; this sheath is closely covered with soft hairs, but the leaf which is expanded has none. The top of the stalk is terminated by a large loose panicle, which hangs on one side, having a chaffy flower, which is succeeded by a small round seed. There are two varieties; one with white, and the other with black seeds; but they differ in no other particular. This plant is seldom cultivated in Britain but in small gardens, for feeding poultry; the seeds generally ripen well. They must be sown in the beginning of April, upon a warm dry soil, but not too thick, because the plants divide into several branches, and should have much room. When they come up they should be cleaned from weeds, after which they will in a short time get the better of them, and prevent the future growth. In August the seeds will ripen, when the plant must be cut down, and the seeds beaten out, as is practised for other grain; but, if it is not protected from birds, they will devour it as soon as it begins to ripen.

MILK, *n. s.* & *v. a.*
MILK'EN, *adj.*
MILK'ER, *n. s.*
MILK'INESS,
MILK'LIVERED, *adj.*
MILK'MAID, *n. s.*
MILK'MAN,
MILK'PAIL,
MILK'PAN,
MILK'POTTAGE,
MILK'SCORE,
MILK'SOP,
MILK'TOOTH,
MILK'THISTLE,
MILK'VETCH,
MILK'WEED,
MILK'WHITE, *adj.*
MILK'WORT, *n. s.*
MILK'WARMER,
MILK'Y, *adj.*
MILK'YWAY, *n. s.*

Sax. meelc, milc; Goth. *mialk*; Teut. *melch*; Dan. and Belg. *melk*. The liquor with which the mammalia supply their young; hence a name sometimes given to the white juice of certain plants: as a verb, to draw or suck out milk: milken and milky mean, consisting of, resembling, or yielding milk; and metaphorically, soft, tender, gentle: a milker is one who draws off the milk from animals: milklivered, cowardly, timorous: a milkman and milkmaid are dealers in milk: milksop, a spiritless, effeminate man: milk-tooth, an early kind of foal's tooth, see below: milk-thistle, milk-vetch, and milk-weed, are plants: milk-wort, a flower: milky-way, the galaxy; that part of the heavens which appears of a confused milky whiteness, from the abundance of its stars.

> She a black silk cap on him began
> To set, for foil of this *milkwhite* to serve.
>
> *Sidney.*

> Of a most notorious thief, which lived all his lifetime of spoils, one of their bards will say, that he was none of the idle *milksops* that was brought up by the fire-side, but that most of his days he spent in arms, and that he did never eat his meal before he had won it with his sword. *Spenser.*

> Come to my women's breasts,
> And take my *milk* for gall. *Shakspeare. Macbeth.*

I fear thy nature,
It is too full o' the *milk* of human kindness
To catch the nearest way. *Id. King Lear.*

I have given suck, and know
How tender 'tis to love the babe that *milks* me.
Shakspeare.

Milklivered man!
That bear'st a cheek for blows, and head for wrongs.
Id.

A *milksop*, one that never in his life
Felt so much cold as over shoes in snow. *Id.*

The bolt of Cupid fell,
It fell upon a little western flower;
Before *milkwhite*, now purple with love's wound;
And maidens call it love in idleness. *Id.*

This *milky* gentleness and course of yours,
You are much more at task for want of wisdom,
Than praised for harmful mildness. *Id.*

Pistachoes, so they be good and not musty, joined with almonds in almond *milk*, or made into a *milk* of themselves, like unto almond *milk*, are an excellent nourisher. *Bacon.*

Sir Fulke Grevil had much and private access to Queen Elizabeth, and did many men good; yet he would say merrily of himself, that he was like Robin Goodfellow; for when the maids split the *milkpans*, or kept any racket, they would lay it upon Robin: so what tales the ladies about the queen told her, or other bad offices that they did, they would put it upon him. *Bacon's Apophth.*

Some stars there are in our hemisphere, like those little sparkles in the galaxy, or *milky* circle, wherein ye can scarce discern any light. *Bp. Hall.*

Perhaps my passion he disdains,
And courts the *milky* mothers of the plains.
Roscommon.

Illustrious robes of satin and of silk,
And wanton lawns more soft and white than *milk*.
Beaumont.

The remedies are to be proposed from a constant course of the *milken* diet, continued at least a year. *Temple.*

When *milk* is dried with heat,
In vain the *milkmaid* tugs an empty teat.
Dryden.

His kine with swelling udders ready stand,
And lowing for the pail invite the *milker's* hand.
Id.

Would I could share thy balmy, even temper,
And *milkiness* of blood! *Id. Cleomenes.*

A *milkwhite* goat for you I did provide;
Two *milkwhite* kids run frisking by her side.
Dryden.

For breakfast and supper *milk* and *milkpottage* are very fit for children. *Locke.*

A lovely *milkmaid* he began to regard with an eye of mercy. *Addison.*

He is better acquainted with the *milkscore* than his steward's accounts. *Id.*

But give him port and potent sack;
From *milksop* he starts up mohack. *Prior.*

Some plants upon breaking their vessels yield a *milky* juice. *Arbuthnot on Aliments.*

Even your *milkwoman* and your nursery-maid have a fellow-feeling. *Id. History of John Bull.*

Broths and *milk*-meats are windy to stomachs troubled with acid ferments.
Floyer on the Humours.

The saltness and oyliness of the blood absorbing the acid of the chyle, it loses its *milkiness*. *Floyer.*

Milkteeth are those small teeth which come forth before when a foal is about three months old, and which he begins to cast about two years and a half after, in the same order as they grew. *Farrier.*

Nor need we with a prying eye survey
The distant skies to find the *milky-way*:
It forcibly intrudes upon our sight. *Creech.*

Capacious chargers all around were laid
Full pails, and vessels of the *milking* trade. *Pope.*

Not tasteful herbs that in these gardens rise,
Which the kind soil with *milky* sap supplies,
Can move the god. *Id.*

How many stars there must be, a naked eye may give us some faint glimpse, but much more a good telescope, directed towards that region of the sky called the *milky-way*. *Cheyne.*

That very substance which last week was grazing in the field, waving in the *milkpail*, or growing in the garden, is now become part of the man.
Watts's Improvement of the Mind.

O, bid him save their harmless lives,
Frae dogs, an' tods, an' butchers' knives!
But gie them guid cow-*milk* their fill,
Till they be fit to fend themsel. *Burns.*

MILK is a well known nutritious fluid, naturally formed in the breasts of women, and udders of other females, for the nourishment of their young. It consists of three parts, viz. the caseous, butyrous, and serous. The first comprehends the grosser earthy particles, which serve to suspend the butyrous part; and which, when coagulated by art, are formed into cheese. The second ingredient comprises the oily particles, or cream, which float on the surface of the milk, and can by agitation be converted into butter. The serous is the watery part which constitutes whey. The most wholesome milk is that which contains a due proportion of these three constituent parts. The milk of women, mares, and asses, nearly agree in their qualities, being very dilute, sweet though ascescent, and, when coagulated, easily broken down. The milk of cows, goats, and sheep, possesses properties widely different. Of these, cows' milk approaches nearest to that of the human breast. But the milk of goats is of a peculiar nature; as its oily and coagulable parts do not separate spontaneously, throw up no cream, and yield no butter. That of sheep is rich and nourishing; produces abundance of butter, but too unpalatable for use. Both these fluids afford a large proportion of strong and tough cheese. Cows' milk forms a very essential part of human sustenance, being adapted to every state of the body, but particularly to infants, after being weaned. It should therefore be drawn from sound, young, and healthy animals; as it is most nutritious when these are between three and four years old. Goats' milk is totally divested of smell, and perfectly white; and although, in general, when used medicinally, or by adults, it ought to be taken undiluted, yet the addition of a little water renders it more easily digestible by the infantine stomach.

MILK, in the wine trade, makes an efficacious forcing for the fining down of all white wines, arracks, and small spirits; but it is by no means to be used for red wines, because it discharges their color. Thus, if a few quarts of well-skimmed milk be put to a hogshead of red wine, it will soon precipitate the greater part of the color, and leave the whole nearly white; and this is of known use in the turning red wines, when pricked, into white; in which a small degree of

acidity is not so much perceived. Milk is, from this quality of discharging color from wines, of use also to the wine-coopers, for whitening wines that have acquired a brown color from the cask, or from having been hastily boiled before fermenting; for the addition of a little skimmed milk, in these cases, precipitates the brown color, and leaves the wines almost limpid, or of what they call a water-whiteness, which is much admired abroad, in wines as well as in brandies.

Milk, Medicinal Qualities of. Dr. Cullen reckons milk an intermediate substance between animal and vegetable substances; as well as between the chyle taken up from the intestines and the fully elaborated animal fluid. He observes that milk is suited to almost all temperaments; and it is even so to stomachs disposed to acescency, more than those substances which have undergone the vinous fermentation; it cures the heart-burn, checks vinous fermentation, and precipitates the lees, when, by renewal of fermentation, the wine happens to be fouled. It therefore very properly accompanies a great deal of vegetable aliment; although sometimes its ascescency is troublesome, either from a large proportion taken in, or from the degree of it. It is reckoned among those foods which occasion costiveness. Hoffman, in his experiments on milk, found that all kinds of it contained much water; and, when this was dissipated, found the residuum very different in solubility. Milk requires only a small exertion of the animal powers for its assimilation. In hectic complaints there is wanted an oily, bland food, approaching the animal nature; on these accounts milk is a diet peculiarly adapted to them, and, in general, to most convalescents, but chiefly those of inflammatory temperaments. Physicians have generally recommended boiled milk in preference to fresh, because milk kept for some time exposed to the air has gone so far to a spontaneous separation; whereas the heat thoroughly blends the whole; hence its resolution is not so easy in the stomach; and thus boiled milk is more costive than raw, and gives more fæces. Again, when milk is boiled, a considerable quantity of air is detached, as appears from the froth on the surface; and air is the chief instrument of fermentation in bodies; so that after this process it is not so liable to acescency: for these reasons it is proper for the robust and vigorous. Another difference of milk is, according as it is fluid or coagulated. The coagulated is of two kinds, as induced by eunet, or the natural acescency of the milk. The former preparation makes the firmer and less easily soluble coagulum; though, when taken with the whey unseparated, it is less difficult of solution, though more so than any other coagulum in the same case. Many nations use the latter form, which is easier soluble, but very much acescent, and therefore, in point of solution, should be confined to the vigorous, in point of acescency, to those who live on alkalescent food; and, in the last case, the Laplanders use it as their chief acescent condiment. From the same considerations it is more cooling, and in its other effects like all other acescent vegetables.

Dr. James Anderson, in his View of the Agriculture of the County of Aberdeen, has the following remark on the proper method of *keeping milk* and butter, which we quote, as it may prove useful. 'The pernicious practice,' says he, 'of keeping milk in leaden vessels, and salting butter in stone jars, begins to gain ground among some of the fine ladies in this county, as well as elsewhere, from an idea of cleanliness. The fact is, it is just the reverse of cleanliness; for, in the hands of a careful person, nothing can be more cleanly than wooden dishes; but under the management of a slattern they discover the secret which stone dishes indeed do not. In return, these latter communicate to the butter and the milk, which has been kept in them, a poisonous quality, which inevitably proves destructive to the human constitution. To the prevalence of this practice I have no doubt we must attribute the frequency of palsies, which begin to prevail so much in this kingdom; for the well known effect of the poison of lead is bodily debility—palsy—death!'

In Ireland, instead of collecting cream from day to day until a sufficient quantity is procured, as the practice is in this country, they churn the whole of the milk together. Thus, in summer, it is prepared in one or two days at most; and, it is worthy of remark, that the butter made in the hottest weather in Ireland is as completely cured for exportation as that which is made in autumn. Hence the advantages of the Irish dairies over those in England arise, not from the climate or soil, for they are nearly the same; nor from the stock, for that in Ireland is greatly inferior to the stock in England, and the best breed they have is in England; certainly, then, the difference must arise in the manufacturing only.

Milk-Vetch. See Astragalus.

Milk-Vetch, Bastard. See Phaca.

Milkwort is a species of euphorbia.

Milkwort. See Polygala.

Milky Way. See Astronomy.

MILL (John), D.D., a very learned divine, born at Shap in Westmoreland, about 1645. He was a servitor of Queen's College, Oxford; and, on his entering into orders, became an eminent preacher, and was made prebendary of Exeter. In 1681 he was created D.D., and appointed chaplain in ordinary to king Charles II., and in 1685 he was elected principal of St. Edmond's Hall in Oxford. His edition of the Greek Testament, which renders his name memorable, was published about a fortnight before his death, which happened in June 1707 Dr. Mill was employed thirty years in preparing this edition.

MILL WORK.

MILL, *n. s.* & *v. a.*
MILL'COG, *n. s.*
MILL'DAM,
MILL'-HORSE,
MILL'-STONE,
MILL'-TEETH,
MIL'LER,
MIL'LER'S-THUMB.
MILL'-WORK.

Sax. myln; Dan. *mølle*; Belg. *molen meulen*; Ital. and Span. *molina muela*; Wel. *melen*; Lat. *mola*; Gr. μυλη. An engine for grinding; applied also in fen countries to drainage-engines of a similar form: to mill is to grind or beat small; also, probably from the overwhelming force employed, to stamp coin: the mill-cog is the wheel-cog: mill-dam the mound by which water is kept up for the use of a mill: mill-teeth, the dentes molares, or grinders: a miller, the manager or proprietor of a mill: miller's-thumb, a small fish, also called a bull's-head: mill-work, the machinery belonging to a mill.

No man shall take the nether or the upper *millstone* to pledge. *Deut.* xxiv. 6.

The table, and we about it, did all turn round by water which ran under, and carried it about as a *mill*. *Sidney.*

A *mill-horse*, still bound to go in one circle. *Id.*

More water glideth by the *mill*
Than wots the *miller* of. *Shakspeare.*

What use were there of the grain, but for the edge of the sickle, wherewith it is cut down; the stroke of the flail, wherewith it is beaten; the weight and attrition of the *mill*, wherewith it is crushed; the fire of the oven, wherewith it is baken? *Bp. Hall.*

Gillius, who made enquiry of *millers* who dwelt upon its shore, received answer, that the Euripus ebbed and flowed four times a day. *Browne.*

Olives ground in *mills* their fatness boast. *Dryden.*

The timber is useful for *mill-cogs*. *Mortimer.*

A layer of lime and of earth is a great advantage in the making heads of ponds and *mill-dams*. *Id.*

It would be better for your *milled* medals, if they carried the whole legend on their edges; but, at the same time that they are lettered on the edges, they have other inscriptions on the face and the reverse. *Addison.*

The best instruments for cracking bones and nuts are grinders or *mill-teeth*. *Arbuthnot on Aliments.*

A *miller* had his arm and scapula torn from his body by a rope twisted round his wrist, and suddenly drawn up by the *mill*. *Sharp's Surgery.*

Wood's half-pence are not *milled*, and therefore more easily counterfeited. *Swift.*

Not so where, scornful of a check, it leaps
The *mill-dam*, dashes on the restless wheel,
And wantons in the pebbly gulf below:
No frost can bind it there. *Cowper.*

'Tis here; this oval box, well filled
With best tobacco finely *milled*,
Beats all Anticyra's pretences
To disengage the encumbered senses. *Id.*

Æsop's beasts saw further into a *mill-stone* than our mobile. *L'Estrange.*

A MILL is a machine for grinding corn, &c., of which there are various kinds, according to the different methods of applying the moving power; as water-mills, wind-mills, mills worked by horses, &c. The first obvious method of reducing corn into flour for bread, was by the simple expedient of pounding; which was for ages practised by the various descendants of Adam, and even continued in use among the Romans below the reign of Vespasian. But the process was very early improved by the application of a grinding power, and the introduction of millstones. This was equally known in the east and west. The Gauls and Britons were familiarly acquainted with the use of hand-mills before their conquest by the Romans; the Britons particularly distinguishing them, as the Highlanders and we do at present, by the appellation of querns, carnes, or stones. And to these the Romans added the very useful invention of water-mills. These machines were common in the country at the conquest of Lancashire. That the Romans introduced these, with their other refinements among us, the British appellations of a water-mill seem to prove; the melin of the Welsh and Cornish, the mul, meill, and melin of the Armoricans, and the Irish muilean and muiland, being all evidently derived from the Roman mola and molendinum. The Britons universally adopted the Roman name, but applied it, as we do, only to the Roman mill; and one of these was probably erected at every stationary city in the kingdom. One (says Mr. Whitaker) plainly was at Manchester, serving equally the purposes of the town and the accommodation of the garrison. And one alone would be sufficient, as the use of hand-mills remained very common in both, many having been found about the site of the station particularly; and the general practice having descended among us nearly to the present period. Such it would be peculiarly necessary to have in the camp, that the garrison might be provided against a siege. And the water-mill at Manchester was fixed immediately below the Castle Field and the town, and on the channel of the Medlock. There, a little above the ancient ford, the sluice of it was accidentally discovered about thirty years ago. On the margin of Dyer's Croft, and opposite to some new constructions, the current of the river accidentally swelled with the rains, and, obstructed by a dam, broke down the northern bank, swept away a large oak upon the edge of it, and disclosed a long tunnel in the rock below. This has been since laid open in part with a spade. It appeared entirely uncovered at the top, was about a yard in width, and another in depth, but gradually narrowed to the bottom. The sides showed every where the marks of the tool on the rock, and the course of it was parallel with the channel. It was bared by the flood about twenty-five yards only in length, but was evidently continued for several yards farther; having originally begun, as the nature of the ground evinces, just above the large curve in the channel of the Medlock.

MILL WORK. Some of the principal mechanical arrangements employed for communicating

motion, in the construction of a mill, have already been examined under the head of MECHANICS; and the formation of COTTON and FLAX mills have been discussed in the articles devoted to those subjects. We are now, however, to examine those branches of the mill-wright art, which lead to a more practical acquaintance with the construction of wheels.

A mill, in the proper sense of the word, signifies a machine for grinding corn; though, in a more general sense, it is applied to all machines which have a horizontal circulatory motion. Mills are distinguished by particular names, sometimes taken from the powers by which they are moved, and sometimes from the uses to which they are applied. Hence they are called hand-mills, horse-mills, water-mills, fulling-mills, wind-mills, corn-mills, boring-mills, &c.

It may be advisable, prior to our entering upon the formation of the teeth of wheels, to furnish a general definition of the terms most commonly in use:

Cog-wheel is the general name of any wheel which has a number of teeth or cogs placed round its circumference.

Pinion is a small cog-wheel that has not in general more than twelve teeth; though, when two toothed wheels act upon one another, the smallest is not unfrequently distinguished by this term; as is also the trundle, lantern, or wallower, when talking of the action of two wheels.

Trundle, lantern, or *wallower,* is sometimes used in lieu of a pinion.

When the teeth of a wheel are made of the same material, and formed of one piece with the body of the wheel, they are called teeth; when of wood, or some other material, and affixed to the outer rim of the wheel, cogs; in a pinion they are called leaves; in a trundle, staves.

When speaking of the action of wheel-work, in general, the wheel which acts as a mover is called the leader, and the one upon which it acts the follower.

If a wheel and pinion are to be so constructed that the one shall give, and the other receive impulse, so that the pinion shall perform four revolutions in the time that the wheel is performing one, they must be represented by two circles, which are in proportion to each other as 4 is to 2. When these two circles are so placed that their outer rims shall touch each other, a line drawn from the centre of the one to the centre of the other, is termed the line of centres; and the radii of the two circles, the proportional radii. These circles are sometimes called proportional circles; but by mill-wrights in general, pitch lines.

The teeth, which are to communicate motion, must be formed upon these two circles. The distance from the centres of two circles to the extremities of their respective teeth, is called the real radii; and in practice the distance between the centres of two contiguous teeth, that is, the distance from the centres of two teeth measured upon their pitch line, is called the pitch of the wheel. The straight part of a tooth, which receives the impulse, is called a flank; and the curved part, that imparts the impulse, the face.

Two wheels acting upon one another in the same plane, having their axes parallel to each other, are called spur geer; when their axes are at right, or other angles, bevelled geer.

If two cylinders be placed in close contact, motion cannot be communicated to the one without that motion, by means of the irregularities of their surfaces, being communicated to the other, and the smaller cylinder shall perform exactly as many revolutions, to one revolution of the larger cylinder, as the larger cylinder contains upon its circumference so many measured circumferences of the smaller cylinder.

Wheels, however, which act by their surfaces only, are ill calculated to transmit motion to any considerable extent, as the motion which the follower has acquired is not of sufficient power to overcome the great resistance which would, in such case, be opposed to it; consequently it becomes necessary to have projections or teeth, and that form of the teeth will be the best which causes the wheel to act as though the motion were communicated by contact of the pitched lines. See WHEEL WORK.

Spur gear. If the three circles 1, 2, 3, fig. 1, plate I, MILL WORK, in contact with the point *a*, be made to revolve about their centres, so that they shall continually touch at the point *a*, their motions will be similar to what would have been generated by one communicating motion to the other two by contact; and circle 3 will move as though rolling on the external surface of circle 1, and internal surface of circle 2, and consequently become the generating circle of the exterior epicycloid on circle 1, and the generating circle of the interior epicycloid on circle 2. As the diameter of circle 3 is equal to the radius of circle 2, the interior epicycloid will be a straight line passing through B, the centre of circle 2; and, supposing the point *a* to have performed that portion of a revolution which places it at K, a portion of the exterior epicycloid will be represented by the line EK, and a portion of the interior epicycloid by DK. Therefore, as the epicycloids, DK and EK, are both generated by one motion of the same point on the same circle, they will continually touch at the generating point, and the total surface of EK will pass over the total surface of DK; and if the epicycloid EK be affixed to the external surface of circle 1, and act upon the portion of the epicycloid DK, it will transmit motion to circle 2, as though that motion were communicated by contact of the pitch lines; which proves that EK presents us with the best form of tooth, and which tooth would, when acting upon the radii of the wheel to be driven, move it as though the motion were communicated by contact.

Fig. 2 represents a mode of forming the teeth of wheels when they are to act upon a trundle. Circle 1 represents the pitch line of the wheel; and circle 2 the pitch line of the trundle; which are supposed to act by contact at the point *a*. When *a* arrives at a^1, it will have traced the portion of an epicycloid represented by a^1 a^2; and, as *a* is the generating point of the epicycloid, the distance from *a* to a^1, and from *a* to a^2, will be equal; and the epicycloid a^1 a^2, being generated by the proportional circle or pitch line of

MILL WORK.

Fig. 9.

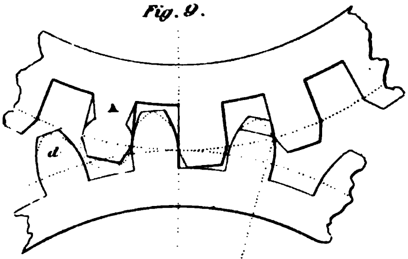
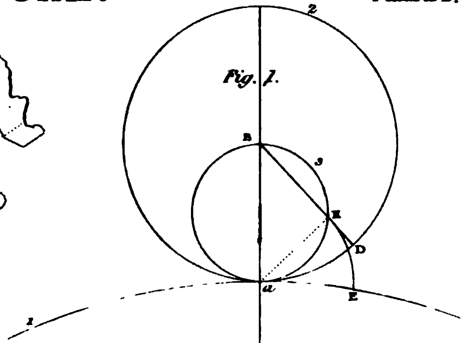


Fig. 1.



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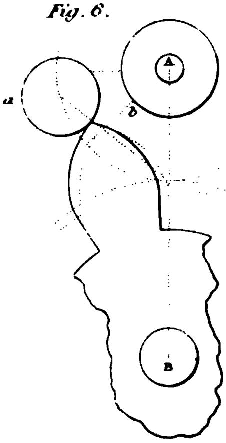


Fig. 2.

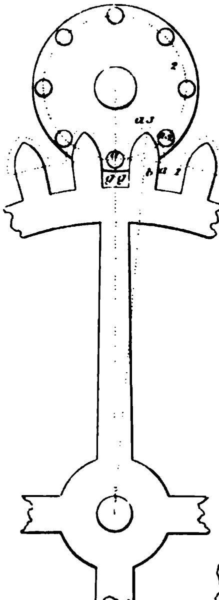


Fig. 7.

Fig. 8.

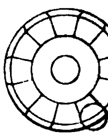


Fig. 4.

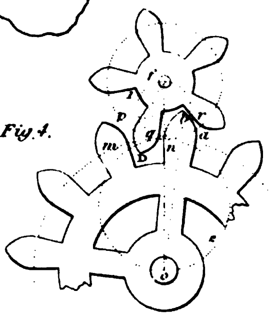


Fig. 5.

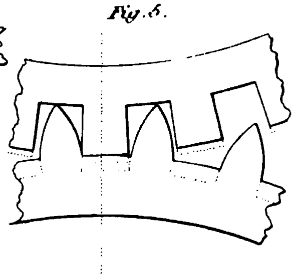


Fig. 10.

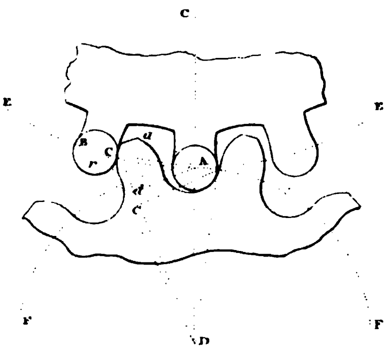
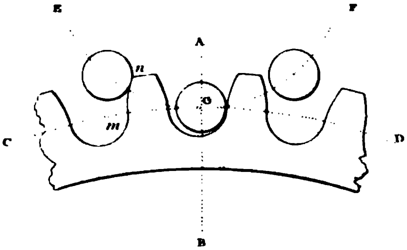


Fig. 3.



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J. Shury sculp.

the trundle, presents us with the most proper form for the tooth of a wheel that is to drive a trundle with circular staves posited in its pitch line.

We shall now proceed to the practical mode of applying these rules. Let circle 2 be the proportional circle or pitch line of a trundle; and circle 1 the pitch line of a wheel which is to drive that trundle; and by the revolutions of these two circles let the portion of an epicycloid, a^1 a^2, be generated, so that when a line is drawn from a^2 to the centre of circle 1, it will intersect that circle at b, whose distance from a^1 is such, that, when the semi-diameter of a staff of the trundle is subtracted from it, the remainder will be equal to half the intended thickness of the tooth of the wheel. Set off perpendicularly to the epicycloid inwards the semi-diameter of one of the staves, at so many points that you will be able to trace through the points thus set off a line parallel to the epicycloid a^1 a^2, which line will be the face of the tooth of the wheel, being less than the tooth formed by the epicycloid a^1 a^2 by the semi-diameter of a staff of the trundle: indeed the diminution must be rather more, as the width, $g\,g$, must be made sufficient for the staves to clear themselves, as the whole of the epicycloidal line must act upon their surface.

To describe the teeth of a wheel for a trundle, by means of circular arcs, let us suppose A B, fig. 3, to be the line of centres, C D the pitch line of the wheel, E F the pitch line of the trundle, and the centre of the staff G to be in the line of centres A B; then, by placing one foot of the compasses in the centre of the staff G, we can describe the arc $m\,n$, which is the form of the face of a tooth, sufficiently near that of an epicycloid for common purposes.

To find the form for the teeth of a wheel, and the leaves of a pinion, which are to act together, we must set off on the pitch lines the points $m\,n\,a$, and $p\,q\,r$, &c., fig. 4, according to the proper thickness of, and distance between, the teeth and leaves, and from these points draw radii to serve as the flanks of the teeth. The spaces must be of sufficient depth to allow for the action of the curved part of the teeth and leaves.

Then, with the generating circle 1, whose diameter is equal to the proportional radius of the pinion, describe upon the extremities of the sides of each tooth, and upon the circumference of the proportional circle of the wheel as a base, the epicycloids $a\,b$, $b\,n$; and, with the generating circle 2, describe upon the proportional circle of the pinion as a base the epicycloid q D, which will give the required form of the teeth and leaves.

For, if the projecting epicycloid $a\,b$ push against the radius $f\,r$ of the proportional pinion, the wheel and pinion will move with equal velocity; and a similar effect will be produced by the epicycloid p D being pushed by the radius $o\,m$ of the wheel towards the line of centres.

When one wheel is to conduct another, it is not necessary that the wheel to be conducted should have teeth of an epicycloidal form; and, were the teeth not subject to wear by friction, there would be no occasion to extend the teeth of the conducted wheel beyond the pitch line; but, such being the case, it becomes necessary to form the teeth of the conducted wheel in the manner represented in fig. 5 by the dotted lines.

Mr. Buchanan, in his Essay on the Teeth of Wheels, objects to this mode of forming the teeth of the conducted wheel, and recommends that a trundle, or wheel with cylindrical staves, should be adopted, as it will be less acted upon in approaching the line of centres, and consequently have less friction than a pinion or wheel the sides of whose teeth tend to the centre.

'This will appear,' says he, 'by fig. 6, which represents a staff a of a trundle, and a leaf b of a pinion, turning round on the same centre A, and a tooth adapted to each, turning on a common centre B. The thickness of each of the teeth, and the proportional circle of both wheels, are the same, and the proportional circles of the pinions are also equal, and teeth are each made of the greatest length which the intersection of the curves will admit, which turns out considerably greater in the tooth adapted to the staff. The shaded parts represent the tooth adapted to, and acting upon, the staff; and the dotted lines represent the tooth adapted to, and acting upon, the leaf. The teeth, in both cases, are represented as just at the point where they would cease to move the leaves or staff uniformly; and it appears the staff is conducted considerably further beyond the line of centres than the leaf; hence the staff will be less acted upon in approaching the line of centres.'

As the trundle in common use is very weak and imperfect, Mr. Buchanan conceived that a wheel might be made which would combine the advantages of both the pinion and trundle; and accordingly had some wheels made, which appeared to answer every expectation.

'These wheels,' says he, 'were made of cast iron; they were each cast of one solid mass. Fig. 7 represents the edge view, and fig. 8 a section of one of them; whereby is shown the manner in which the teeth are supported like the staves of a trundle at each end, and like the leaves of a pinion at the roots, but so very thin there as to run no risk of having the common fault of pinions just now noticed. I mentioned,' he continues, 'in cases where the pinion had few teeth, that in the conductor, whether wheel or pinion, staves should be preferred; but it is obvious that the method just described, of making a small trundle of cast iron, would not apply to a wheel of a great number of staves. Nor is it in that case so necessary; as the greater the number of teeth are, the longer they will be in losing their proper figure. In such cases, therefore, staves, strictly speaking, should not be used, but teeth made so as to produce the same effect; that is, having their acting parts of the figure of a staff. What is meant will be better understood by inspecting fig. 9, where the lines show the alteration necessary on the tooth A, in order to make it produce the effect of a staff; which staff is represented by the faint dots. The dotted lines on d represent the alteration requisite to adapt it to the staff; it being necessary, as formerly proved, to have it a different epicycloid from what is required to adapt it to a tooth whose acting part is a straight line, tending to the centre of its proportional circle.'

'Teeth,' says Mr. Tredgold, 'seem to be very well adapted for various purposes, when formed on the principle recommended in the preceding article. I therefore will endeavour to show a simple method of describing such teeth. It must be observed, that the teeth, to resemble staves, are to be always on the conducted wheel or pinion; thus affording the peculiar advantage of the wheel and trundle in either increasing or diminishing velocity.

'Let the teeth be divided as usual on the pitch lines E E, F F, fig. 10; and on the conducted wheel C describe circles, as though they were to be staves. Conceive the centre of one of these staff teeth to be in the line of centres at A, and draw the line A B joining the centres of the staff teeth. Then the radius A *b*, from the centre A, will describe the curved side *b c* of the tooth of the conductor, and the curved part *b a* of the conducted wheel. And since this radius is equal to the pitch diminished by half the diameter of the circle of the staff teeth, and the centres will always be in the pitch lines of the wheels, all the other teeth may be easily described.'

When a pinion is to act internally, as in fig. 1 plate 2, it is evident that the teeth may be formed on the principles already laid down, with this difference only, that the epicycloid, generated by the proportional circle of the pinion upon that of the wheel, should be an interior epicycloid. The internal pinion may be adopted in many cases with advantage, as it has less friction than the external one.

To illustrate this, let A, fig. 2, be the pitch line of a wheel, B that of an internal pinion, and *c* that of an external pinión. Suppose the circle A to be moved till the point *a* arrives at *b*, and that the points *c*, *d*, in the circles B, C, have both moved over a space equal to *a*, *b*. Now it is evident that the distance from *c* to *b* is much less than that from *b* to *d*, and, consequently, had the circles moved one another by means of teeth, a tooth of the interior circle B, in the same part of a revolution, would have slid over a smaller part of a tooth of the circle A than a tooth of the exterior circle C, and therefore would have had less velocity. But, other things being equal, the less the velocity, the less the friction; an interior pinion has consequently less friction than an exterior one.

It is upon this principle that bevelled wheels have less friction than external spur wheels; bevelled wheels acting in a mean situation between external and internal spur wheels.

The rack and pinion should be made on the principles of spur geers; with this difference only, that, in forming the teeth, the cycloid is, for reasons obvious from its definition, used in place of the epicycloid.

Dr. Johnson gives this definition of the cycloid:—'A geometrical curve, of which the genesis may be conceived by imagining a nail in the circumference of a wheel: the line which the nail describes in the air, while the wheel revolves in a right line, is the cycloid.'

Thus A B C, fig. 3, is a cycloid generated by the point *a* in the circle D, while it revolves in the right line A C.

Fig. 4 represents the teeth of a rack and pinion, formed in what seems the best mode, in cases where a great weight is attached to the rack. The leaves of the pinion are made as long as the curve will admit, in order to prevent them from beginning to act before they arrive in the line passing through the centre of the pinion, perpendicular to the rack. Were they to act much before they arrived in that line, which may be considered as the line of centres, and against a very great weight, they would be apt to jam, and run the risk of their being broken, or at least very much increase the friction.

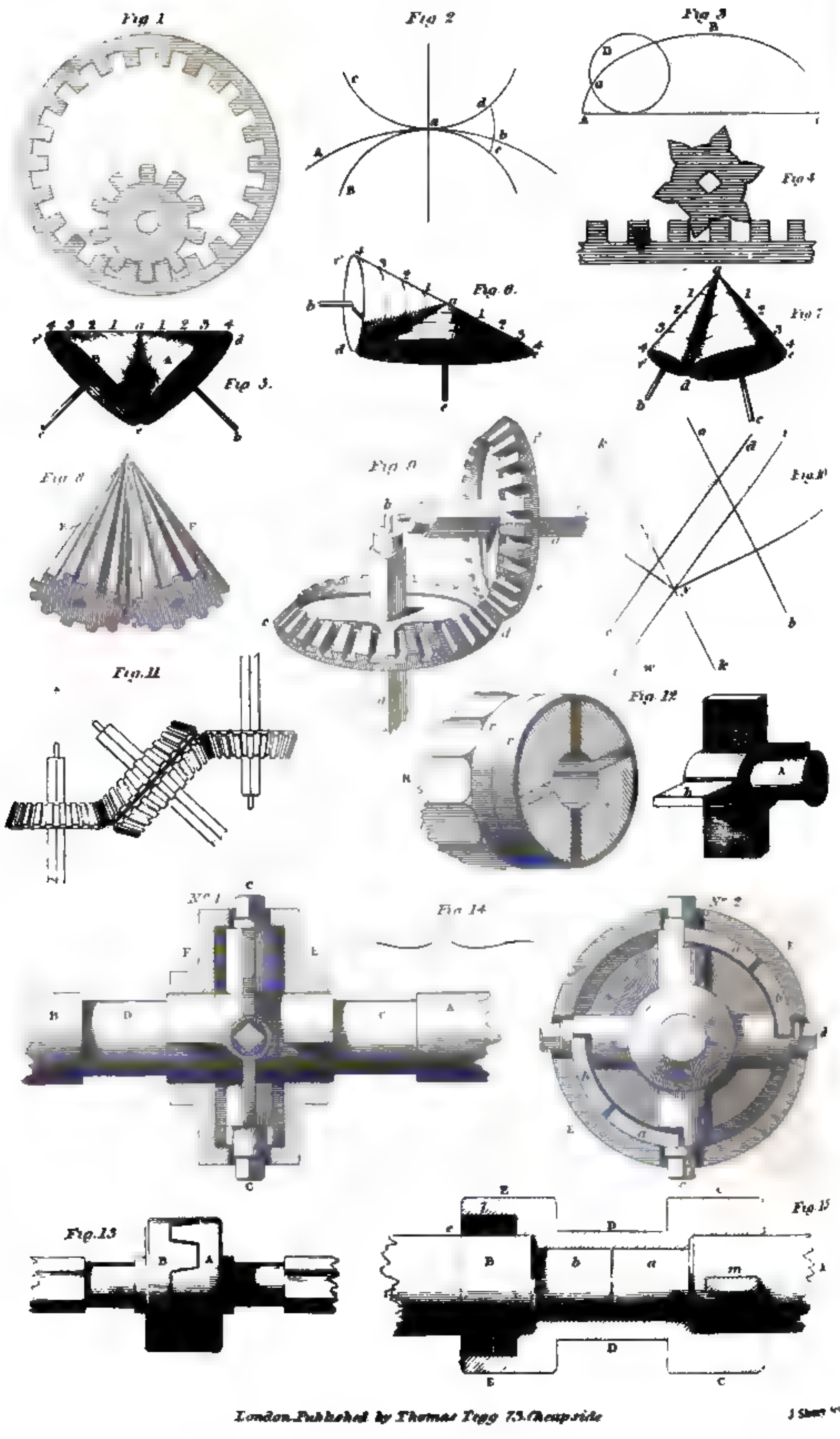
Mistaken attempts at economy have often prompted the use of wheels of too small diameter. This is an evil which ought carefully to be avoided. Knowing the pressure on the teeth, we cannot, with propriety, reduce the diameter of a wheel below a certain measure.

Suppose, for instance, a water-wheel of twenty horses' power, moving at the pitch line with a velocity of three feet and a half per second: it is known that a pinion of four feet diameter might work into it without impropriety; but we also know that it would be exceedingly improper to substitute a pinion of only one foot diameter, although the pressure and velocity at the pitch lines in both cases would be, in a certain sense, the same. In the case of the small pinion, however, a much greater stress would be thrown on the journeys (or journals) of the shaft. Not, indeed, on account of torsion or twist, but on account of transverse strain, arising as well from greater direct pressure as from the tendency which the oblique action of the teeth, particularly when somewhat worn, would have to produce great friction, and to force the pinion from the wheel, and make it bear harder on the journals. The small pinion is also evidently liable to wear much, on account of the more frequent recurrence of the friction of each particular tooth.

That these observations are not without foundation is known to mill-wrights of experience. They have found a great saving of power by altering corn mills, for example, from the old plan of using only one wheel and pinion (or trundle) to the method of bringing up the motion by means of more wheels and pinions, and of larger diameters and finer pitches. The increase of power has often, by these means, been nearly doubled, while the tear and wear has been much lessened; although it is evident the machinery, thus altered, was more complex.

The due consideration of the proper communication of the original power is of great importance for the construction of mills on the best principles. It may easily be seen that, in many cases, a very great portion of the original power is expended before it is actually applied to the work intended to be performed.

Notwithstanding the modern improvements in this department there is still much to be done. In the usual modes of constructing mills due attention is seldom given to scientific principles. It is certain, however, that, were these principles better attended to, much power that is necessarily expended would be saved. In general this might be in a great measure obtained by bringing on the desired motions in a gradual manner, beginning with the first very slow, and



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gradually bringing up the desired motions by wheels and pinions of larger diameters. This is a subject which should be well considered before we can determine, in any particular case, what ought to be the pitch of the wheels. In the case above alluded to, where the supposition is a pinion of four feet diameter, or of one foot diameter, it is obvious that the same pitch for both would not be prudent. That for the small pinion ought to be much less than that which might be allowed in the case of the larger pinion. It is also equally obvious that the breadth of the teeth, in the case of the small pinion, ought to be much greater than that in the case of the larger pinion. It is evident, however, that, although great advantage may often be derived from a fine pitch, there is a limit in this respect, as also with regard to the breadth.

Hitherto our enquiry has been confined to what is called spur-geer, or the action of wheels and pinions whose axes are parallel; we come now to speak of bevel-geer, or the action of wheels of which the axes are angular to each other.

The principle consists in two cones rolling on the surface of each other, as the cones A and B revolving on their centres *a b*, *a c*, fig. 5; if their bases are equal they will perform their revolutions in one and the same time; or any other two points equally distant from the centre *a*, as *d* 1, *d* 2, *d* 3, &c., will revolve in the same time as *f* 1, *f* 2, *f* 3, &c. In the like manner, if the cones *a*, *d*, *e* be twice the diameters at the base *d e* as the cones *a*, *f*, *e*, are, then if they turn about their centres, when the cone *a f d*, figs. 6 and 7, has made one revolution, the cone *a d e* will have made but half a revolution; or when *a f e* has made two revolutions, *a d e* will have made but one, and every part equally distant from the centre *a*, as *f* 1, *f* 2, *f* 3, &c., will have made two revolutions to *e* 1, *e* 2, *e* 3, &c.; and if the cones were fluted, or had teeth cut in them, diverging from the centre *a* to the bases *d*, *c*, *e*, *f*, they would then become bevel geer. The teeth at the point of the cone, fig. 8, being small, and of little use, may be cut off at E and F, figs. 8 and 9, where the upright shaft *a b*, with the bevel-wheel *c d*, turns the bevel-wheel *e f* with its shaft *b g*, and the teeth work freely into each other. The teeth may be made of any dimensions, according to the strength required; and this method will enable them to overcome a much greater resistance, and work smoother than a face-wheel and wallower of the common form can possibly do; besides, it is of great use to convey a motion in any direction, or to any part of a building, with the least trouble and friction.

The method of conveying motion in any direction, and proportioning or sharpening the wheels thereto, is as follows:—let the line *a b* represent a shaft coming from a wheel; draw the line *c d* to intersect the line *a b* fig. 10, in the direction that the motion to be conveyed is intended, which will now represent a shaft to the intended motion.

Again, suppose the shaft *c d* is to revolve three times, whilst the shaft *a b* revolves once; draw the parallel line *i i*, at any distance not too great (suppose one foot by a scale), then draw the parallel line *k k* at three feet distance, after which draw the dotted line *w x*, through the intersection of the shaft *a b* and *c d*, and likewise through the intersection of the parallel lines *i i* and *k k*, in the points *x* and *y*, which will be the pitch-line of the two bevel-wheels, or the line where the teeth of the two wheels act on each other, as may be seen fig. 11, where the motion may be conveyed in any direction.

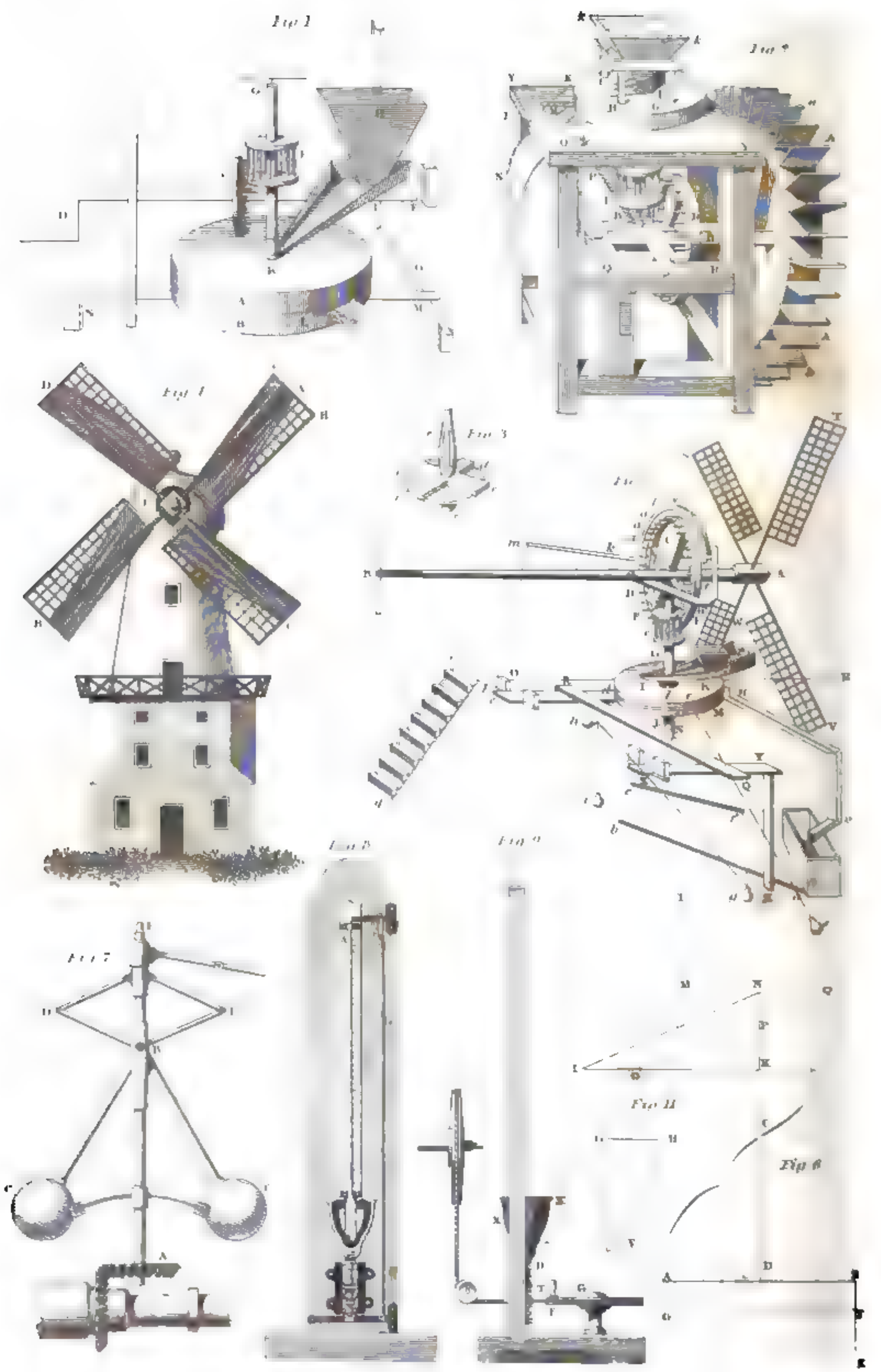
In almost all modern mills the shafts or spindles for the conveyance of motion, and support of wheels, are made of iron, either wrought or cast. Square shafts are the most common, but sometimes octagon and round ones are used; and if they are very large they are cast hollow, like pipes, and the gudgeons fixed in at the ends by wedges; but the pivots should always, if possible, be formed of the same piece of metal, as the slightest possible deviation from the straight line causes them to strain, and work very irregularly in their bearings. In wooden shafts this is impracticable, and it is one of the greatest objections to the use of them. The best method of fixing gudgeons into wooden shafts is shown in fig. 12. Here A is the gudgeon, made in cast iron, turned true; it has four leaves *a*, *b*, *c*, *d*, forming a cross, which is let into the end of the wooden shaft R; the front edge of each leaf is considerably thinner than the back, so that a pair of strong iron hoops *r r*, being driven tight on the end of the shaft, closes the wood round the cross, and holds it fast, and, the back of the leaves being wider than the front, it will not come out. As an additional security screws are sometimes put in: these are put through holes in the arms of the cross, which are then made flat the other way, and do not go so far into the wood. The screws go into the timber a considerable distance, where a mortise is cut into the wood, to meet the end of the bolt, and an iron nut is dropped in, to screw the bolt into, when it is turned round by a screw-driver. By this contrivance a gudgeon may be fitted into a wooden shaft very fast; but still it will never come into competition with iron shafts, when the gudgeon is made all in one solid piece with the whole of the shaft. A judicious mechanic will never make more than two bearings upon any one shaft, if it can be avoided, because, if the three by any means, as the warping of the frame work or other cause, get the smallest possible quantity out of the straight line, they can never work well afterwards, but will always strain and wear the bearings with great friction. In very extensive mills, such as woollen and cotton mills, breweries, &c., when the buildings are of great length, it becomes necessary to join several shafts together in length, to reach from one end to the other of a mill. The manner of making the joinings is of some consequence: it is necessary that every shaft should have a bearing at each end, and consequently that the connexion of the ends of every one should be made by uniting the ends of the shafts which project beyond their bearings. This can be done in various ways; one is by having the ends of each of the shafts provided with circular heads A B, fig. 13, which have teeth in one, and corresponding indentations in the other,

to receive them, and thus one is made to turn the other about, at the same time that if any slight settlement of the building or other cause depresses one of the bearings, or raises another, so as to put the two shafts out of the perfect straight line they ought always to preserve, these joints will admit the slight flexure, and still communicate the motion of one shaft to the other.

As this accidental settlement in large buildings is almost unavoidable, in some degree, care should be taken to make such joints as will admit of a trifling bending. Sometimes the ends of the shaft are made circular, and turned quite true in the lathe; then a metal tube or collar is fitted truly upon both, to cover the joint, and connect them, a bolt being put through each end, which unites both shafts with the collar, and thus by means of it causes the one to turn the other round. This method is sometimes used to save the great expense of having a bearing at each end of every length of shaft, one bearing to each length being then sufficient, the other end of the shaft being supported by this collar, connecting it with the end of the adjacent length just where it projects beyond its bearing. But this is not a good method, as the shafts are apt to bend and work with so much friction in the bearings, if they get the least out of the straight line, because these kind of joints will not admit any flexure of the shaft; or, if they do, they will only bend on one side, whereas it is necessary for the joints to bend successively on all sides, when the bearings are not precisely in a straight line. Fig. 14 represents a coupling-box, used by Messrs. Murray and Co. of Leeds, for connecting the lengths of a long line of shaft which are to carry a heavy strain: it is so made that it will communicate the motion in the manner of a universal joint, if they should be out of the line. Let A, B, be the two shafts to be united; C, D, their necks or collars which lie in the bearings: the ends projecting beyond these have boxes E, F, fixed on them, either by a square with wedges, or by a round part with a fillet; one of these boxes E has a piece projecting from the inside of it on each side, and extending into the other box, as is shown at *a a*, No. 2, which is an inside view: the other box F has two similar pieces projecting from it at *b b* into the other box E; within the boxes an iron cross *c c d d* is situated; it has screws fixed into the ends of the cross, and by these the motion is communicated: thus the pieces *a*, *a*, when the shaft A and box E are turned round in the direction of the arrows No. 2, act against the screws *c*, *c*, of the cross, and turn it about: at the same time the other two screws *d*, *d*, at the other arms of the cross, press against the pieces *b*, *b*, which belong to the box and shaft B, thus turning them round: the cross is placed quite detached in the boxes, and thus acts as a universal joint, to communicate the motion of one to the other: the screws *c c*, *d d*, at the ends of the cross, are only put in that the acting points may be made of steel, and made smooth to have but little friction in these parts. Another method of uniting shafts by Mr. Murray is shown at fig. 15: it has the advantage of requiring only one bearing for every length of shaft, whereas the above method requires one for each end of every length. A, B, represent the two shafts; each has a pivot formed at the end: these pivots are fitted into a coupling piece C D E, which is bored out truly to fit them inside, and the outside turned true, with a neck D D, which is received and fitted into a bearing: the two shafts A, B, are connected with the coupling piece D, at C and E, by means of a cross key *l m*, put through each shaft, and the ends of them received in notches made within side of the coupling piece at C and E, where it receives the ends of the shafts. It is to be observed that the shafts do not fit tight in these parts E and C, but only in the pivots *a*, *b*, within, by which means they have liberty of a little motion, and this without straining the bearing in which D runs, because it is only the short coupling piece which is received therein; and consequently any trifling deviation from the straight line will not strain it, because of the play allowed in the fittings.

In treating of the mill in its complete state we may commence with its simplest form. The hand-mill will first engage our attention. It is shown in fig. 1, plate III. where A and B represent the two stones between which the corn is ground, and of which the upper one A turns round, but the lower one B remains fixed and immoveable. The upper stone is five inches thick, and twenty-one inches broad; the lower one somewhat broader. C is a cog-wheel, having sixteen or eighteen cogs, which go into the trundle F, having nine spokes fixed to the axis G, the latter being firmly inserted into the upper stone A, by means of a piece of iron. H is the hopper into which the corn is put: I the shoe to carry it by little and little through a hole at K, in betwixt the stones, where being ground into meal it comes out through the eye at L. Both stones are enclosed in a circular wooden case, of such a size as will admit the upper one to run freely within it. The under surface of the upper stone is cut into grooves, as represented at Q, which enable it to throw the meal out at the eye L more perfectly than could be done if it were quite plain. Neither of them are entirely flat, the upper one being somewhat concave, and the under one convex. They nearly touch at the edges, but are at some distance in the middle, in order to let the corn go in between them. The under stone is supported by strong beams, not represented in the figure; the spindle G stands on the beam M N, which lies upon the bearer O. One end of this bearer rests upon a fixed beam, and the other has a string fixed to it, and going round the pin P, by the turning of which the timbers O and M N may be raised or lowered, and thus the stones put nearer, or removed farther from each other, in order to grind fine or coarse. When the corn is to be ground it must be put into the hopper by little at a time. A man turns the handle D, and thus the cog-wheel and trundle are carried round also together with the stone A. The axis G is angular at K; and, as it goes round, shakes the shoe I, and makes the corn fall gradually through the hole K. The upper stone going round grinds it, throwing out the meal, as already said, at the eye L. Another handle, if thought proper, may be put at

MILL WORK.



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J. Shury Sculp.

the other end of the handle E. The spindle must go through both stones, in order to reach the beam M N, and the hole through which it passes is fastened with leather or wood, so that no meal can pass through.

The construction of a horse-mill does not differ very materially from that of the hand-mill just described; instead, however, of the handle D, the spindle is furnished with a long horizontal lever and cogged wheel, which turns the trundle and stones, as already mentioned.—The stones are much heavier than in the hand-mill.

The mills most commonly in use for grinding corn are water-mills, the construction of which is not essentially different from that of the hand or horse-mills. The lower mill-stone, as already mentioned, is fixed, but the upper one moveable upon a spindle. The opposite surfaces of the two stones are not flat, but the one convex and the other concave, though in a very small degree. The upper stone, which is six feet in diameter, is hollowed only about an inch in the middle, and the other rises three-quarters of an inch. They approach much nearer each other at the circumference, and the corn begins to be ground about two-thirds of the radius distance from the circumference, and there it makes the greatest resistance, the space between the two stones being in that place only about two-thirds or three-fourths of the thickness of a grain of corn; but as these stones, as well as those of the hand-mill or horse-mill, can be separated a little from each other, the meal may be made fine or coarse in them, as well as in the two former mills.

To cut and grind the corn, both the upper and under stones have furrows cut in them, as is observed in the hand-mill These are cut perpendicularly on one side, and obliquely upon the other, by which means each furrow has a sharp edge, and by the turning of the stones the furrows meet like a pair of scissars, and by cutting the corn make it grind the more easily. They are cut the same way in both stones when they lie upon their backs, by which means they run crossways to each other when the upper one is inverted and turned round; and this greatly promotes the grinding of the corn, great part of which would be driven onward in the lower furrows, without being ground at all, if both lay the same way. When the furrow becomes blunt and shallow, by wearing, the running stone must be taken off, and the furrows cut deeper in both by means of a chisel and hammer. Thus, however, by having the furrows cut down a great number of times, the thicknesses of both stones are greatly diminished; and it is observed, that in proportion to the diminution of the thickness of the upper stone, the quantity of flour also diminishes.

By means of the circular motion of the upper stone the corn is brought out of the hopper by jerks, and recedes from the centre towards the circumference by the centrifugal force; and, being entirely reduced to flour at the edges when the stones nearly touch one another, it is thrown at last out at the hole called the eye, as already mentioned. In Scotland it is frequent to have the stones without any furrows, and only irregularly indented with small holes, by means of an iron instrument. Stones of this kind last a much shorter time than those with furrows, the latter being fit for use for thirty or forty years, while the former seldom or never last more than seven. The under mill-stone is considerably thicker than the upper; and therefore, when both have been considerably worn by use, the lower one is frequently taken up, and the upper one put in its place, the former being converted into a running stone.

Water-mills are of three kinds, viz. breast-mills, undershot-mills, and overshot-mills. In the former the water falls down upon the wheel at right angles to the float-boards or buckets placed all round to receive it; if float-boards are used it acts only by its impulse; but, if buckets, it acts also by the weight of water in the buckets in the under quarter of the wheel, which is considerable. In the undershot-wheel float-boards only are used, and the wheel is turned merely by the force of the current running under it, and striking upon the boards. In the overshot-wheel the water is poured over the top, and thus acts principally by its weight; as the fall upon the upper part of the wheel cannot be very considerable, lest it should dash the water out of the buckets. Hence it is evident that an undershot-mill must require a much larger supply of water than any other; the breast-mill the next, unless the fall is very great; and an overshot-mill the least. Dr. Desaguiliers found that a well-made overshot-mill would perform as much work as an undershot one, with one-tenth part of the quantity of water required by the other.

Plate III. fig. 2, shows the construction of a common water-mill, where A A is the large water-wheel, commonly about seventeen or eighteen feet diameter from a, the extremity of any float-board, to b the extremity of the opposite one. This wheel is turned round by the falling of the water upon the boards from a certain height, and the greater the height, provided the water runs in an uninterrupted stream, the smaller quantity will be sufficient to turn the mill. This wheel is without the mill-house, but the wheel has an axle B B of considerable length, which passes through a circular hole in the wall, and has upon it a wheel D, of eight or nine feet diameter, having sixty-one cogs, which turn a trundle E of ten staves or spokes; by which means the trundle, and consequently the mill-stone, will make six revolutions and one-tenth for every revolution of the wheel. The odd cog, commonly called the hunting cog, is added, that as every one comes to the trundle it may take the staff behind that one which it took at the last revolution; and thus all the parts of the cogs and rounds which work upon one another will wear equally, and to equal distances from one another, in a little time; by which means a true uniform motion will be produced through the whole work. The trundle is fixed upon an iron axis called the spindle, the lower end of which turns in a brass pot fixed at F in the horizontal beam S T, called the bridge-tree; and the upper part of the spindle turns in a wooden bush, fixed into the lower mill-stone, which lies

upon beams in the floor Y Y. The top part of the spindle above the bush is square, and goes into a square hole in a strong iron cross, *a b c d*, fig. 3, called the rind; under which, close to the bush, is a round piece of thick leather upon the spindle, which it turns round at the same time that it does the rind. The latter enters into the grooves in the under surface of the running mill-stone G, fig. 2, and thus turns it round along with the trundle E, by means of the cog-wheel D. In the middle of the upper mill-stone is a large hole called the eye, through which the middle part of the rind and upper part of the spindle may be seen: the ends being hid in the grooves below the stone. The end T of the bridge-tree T S, which supports the upper mill-stone G upon the spindle, is fixed into a hole in the wall; and the end S is let into the beam Q R, called the brayer; one end R of which remains fixed in a mortise, while the other end Q hangs by a strong iron rod P, which goes through the floor Y Y, and has a screw-nut on its top O; by the turning of which nut the end Q of the brayer is raised or depressed at pleasure, along with the bridge-tree T S and upper mill-stone. Thus the upper mill-stone may be raised as high from the under one, or let down as close to it as the miller pleases; by which means the meal or flour is made either coarse or fine at pleasure. The upper mill-stone G is enclosed in a round box H, which leaves a vacant space of about an inch all round. On the top of this box stands a frame for holding the hopper *k k*, at which hangs the shoe I, by two lines fastened to the hinder part of it, fixed upon hooks in the hopper, and by one end of the string K to the fore part of it at *i*, the other end being twisted round the pin L. As the pin is turned one way the string draws up the shoe closer to the hopper, and so lessens the aperture between them; and, as the pin is turned the other way, it lets down the shoe, and widens the aperture. If it be drawn quite up to the hopper, no corn can fall out from the latter into the mill, and the quantity will be greater or less as the shoe is farther from the hopper or nearer to it. This happens by reason of the hopper being open at bottom, and the shoe at the forepart towards the end *i* over the middle of the eye of the mill-stone. There is also a square hole in the top of the spindle, in which is put the feeder *e*, fig. 3. Thus the shoe is shaken three times in each revolution, and the corn runs constantly down from the hopper through the shoe into the eye of the mill-stone, where it falls upon the top of the rind, and, by the motion of that and of the leather beneath, is introduced betwixt the stones, and by the violent motion of the upper one acquires a centrifugal force; and, proceeding gradually from the eye of the mill-stone towards the circumference, is thrown at last out in flour, at the hole called the eye of the mill.

Some degree of nicety is requisite in feeding the mill; for, if too great a quantity be poured into it, the stones are separated from each other more than they ought to be, and their motion is also impeded; while, on the other hand, if it be fed too slowly, the stone moves with too great velocity, and the attrition of the two is apt to make them strike fire. This matter is regulated by turning the pin L backwards or forwards as the miller thinks proper. Sometimes, where plenty of water can be had, there are two trundles applied to the cog-wheel by means of a single large one turned immediately by the perpendicular cog-wheel, and carrying round with it a horizontal cogged wheel; on each side of which are placed the smaller trundles abovementioned, carrying the stones. In like manner the water-wheel may be made to drive fanners, bolting-mills, &c.; but it must always be remembered, that, by complicating machinery to a great degree, it becomes more ready to give way; and the frequent reparation of which it stands in need will, by the delay of business, be found at last more expensive than if separate machines had been used.

The wind-mill is furnished with an apparatus similar to the water-mill, but necessarily differs in the external apparatus for applying the power. This is done by means of the two arms A B and C D fig. 4, intersecting each other at right angles in E, and passing through the axis E F, and about thirty-two feet in length. On these yards are placed two sails or vanes, in the shape sometimes of parallelograms, and sometimes of trapeziums, with parallel bases; the greater whereof H I is about six feet, and the length of the smaller F G is determined by radii drawn from the centre E to I and H.

As the direction of the wind is very uncertain, it becomes necessary to have some contrivance for turning the sails towards it, to receive its force in whatever way it may turn; and for this purpose two general methods are in use. In the one, the whole machine is sustained upon a moveable arbor or axis, perpendicular to the horizon, and which is supported by a strong stand or foot very firmly fixed in the earth; and thus, by means of a lever, the whole machine may be turned round as occasion requires. In the other method, only the roof, which is circular, can be turned round by means of a lever and rollers, upon which the circular roof moves. This last kind of wind-mill is always built of stone, in the form of a round turret, having a large wooden ring on the top of it, above which, the roof, which must likewise be of wood, moves upon rollers, as has been already mentioned. To effect this motion the more easily, the wooden ring, which lies on the top of the building, is furnished with a groove, at the bottom of which are placed a number of brass truckles at certain distances, and within the groove is placed another ring, by which the whole roof is supported. The beams *a b* and *a e* are connected with the moveable ring, and a rope is fastened to the beam *a b* in *b*, which at the other extremity is fitted to a windlass or axis in peritrochio; and this rope being drawn through the iron hook G, and the windlass turned round, the sails and roof will be turned round also, in order to catch the wind in any direction. Both these methods of construction have their advantages and disadvantages. The former is the least expensive, as the whole may be made of wood, and of any form that is thought proper; while the other requires a costly building of stone; and, the roof

being round, the building must also be so, while the other can be made of any form, but has the inconvenience of being liable to be carried off altogether by a very high wind.

Plate III. fig. 5, shows the internal mechanism of a wind-mill. A H O is the upper room; H *o* Z the lower one; A B the axle-tree passing through the mill; S T V W the sails covered with canvass set obliquely to the wind, and turning round in the order of the letters. C D is the cog-wheel, having about forty-eight cogs *a*, *a*, *a*, &c., which carry round the lantern E F, having eight or nine trundles *c*, *c*, *c*, &c., along with the axis G N. I K is the upper mill-stone, L M the lower one; O R is the bridge supporting the axis or spindle G N, which rests upon the beams *c d*, X Y, wedged up at *c*, *d*, and X: Z Y is the lifting tree, which stands upright; *a b* and *e f* are levers, having Z and *e* as centres of motion; *f g h i* is a cord, with a stone *i* wound about the pins *g* and *h*, and which thus serves as a balance or counterpoise. The spindle *t* N is fixed to the upper mill-stone I K by means of a piece of iron called the rind, and fixed in the lower side of the stone, the whole weight of which rests upon a hard stone fixed in the bridge Q R at N. The trundle E F and axis G may be taken away; for it rests its lower part by *t* in a square socket, and the top runs in the edge of the beam *w*. By bearing down the end of the lever *f e* we raise *b*, which raises also Z Y, and this raises Y X, which lifts up the bridge Q R, with the axis N G, and the upper stone I K; so tha. by this contrivance the stones may, as in a water-mill, be set at any distance. The lower stone is fixed upon strong beams, and is broader than the upper one; the flour being conveyed through the tunnel *n o* into a chest. P is the hopper into which the corn is put, and which runs along the spout *r* into the hole *t*, and so falls between the stones, where it is ground. The square axis G *t* shakes the spout *r* as it turns round, and makes the corn run out; *r* is a string going round the pin *s*, which serves to bring the spout nearer or let it go farther from the axis, and thus makes the corn to run faster or slower, according to the velocity of the wind. If the wind be very strong, only part of the sails S, T, V, W, is covered, or perhaps only one-half of the two opposite sails. Another cog-wheel B is placed towards the end B of the axle tree, with a trundle and mill-stones like those already described; so that when the wind is strong the mill may do twice the business it ordinarily does. When only one pair is to grind, the trundle E F and axis G *t* are taken out from the other; *x y l* is a girt of pliable wood, fixed at the end *x*; and the other end *l* is tied to the lever *k m*, moveable about *k*; and the end *m*, being put down, draws the girt *x y l* close to the cog-wheel; and thus the motion of the mill may be stopped at pleasure; *p q* is a ladder for ascending to the higher part of the mill; and the corn is drawn up by a ·ope rolled about the axis A B.

In all mills it is necessary that a considerable power be employed in order to accomplish the intended purpose. Water is the most common power, and indeed the best, as being the most constant and equable; while wind comes at some times with great violence, and at others is totally gone. Mills may also be moved by the force of steam, as were the Albion mills at London; but the expense of fuel must undoubtedly prevent this mode of constructing mills from ever becoming general. In all cases it is absolutely necessary to make the most of the power that we can, by making it act to the greatest advantage. Hence the best methods of constructing water and wind-mills have been investigated by those who were most conversant in the principles of mechanics; and so difficult has been the investigation, that the principles are not yet settled absolutely without dispute.

In the fifty-first volume of the Philosophical Transactions, Mr. Smeaton has considered at great length the best methods of constructing all these mills from machines and models made on purpose; but, conscious of the inferiority of models to actual practice, did not venture to give his opinion without having seen them actually tried, and the truth of his doctrines established by practice.

Having described the machines and models used for making his experiments, he observes that, with regard to power, it is most properly measured by the raising of a weight: viz. if the weight raised be multiplied by the height to which it can be raised in a given time, the product is the measure of the power raising it; and, of consequence, all those powers are equal whose products made by such multiplication are equal; for if a power can raise twice the weight to the same height, or the same weight to twice the height, in the same time that another can, the former power will be double the latter; but if a power can only raise half the weight to double the height, or double the weight to half the height, in the same time that another can, the two powers are equal. This, however, must be understood only of a slow and equable motion, without acceleration or retardation; for if the velocity be either very quickly accelerated or retarded, the vis inertiæ, in our author's opinion, will produce an irregularity.

'To compute the effects of water-wheels exactly, it is necessary to know, in the first place, what is the real velocity of the water which impinges on the wheel; 2. The quantity of water expended in a given time; and, 3. How much o. the power is lost by the friction of the machinery.

1. With regard to the velocity of the water, Mr. Smeaton determined by experiments, with the machinery described in the volume referred to, that with a head of water fifteen inches in height, the velocity of the wheel is 8·96 feet in a minute. The area of the head being 105·8 inches; this, multiplied by the weight of a cubic inch of water, equal to ·579 of an ounce avoirdupois, gives 61·26 ounces for the weight of as much water as is contained in the head, upon one inch in depth; and by farthei calculations, derived from the machinery made use of, he computes that 264·7 lbs. of water descend in a minute through the space of fifteen inches. The power of the water, therefore, to produce mechanica. effects in this case will be $264 \cdot 7 \times 15$, or 3970. From the result of the experiment, however, it

appeared that a vast quantity of the power was lost; the effect being only to raise 9·375 lbs. to the height of 135 inches; so that the power was to the effect as 3970 to $9·375 \times 135 = 1266$, or as 10 to 3·18.

This, according to our author, must be considered as the greatest single effect of water upon an undershot wheel, where the water descends from a height of fifteen inches; but, as the force of the current is not by any means exhausted, we must consider the true proportion betwixt the power and effect to be that betwixt the quantity of water already mentioned and the sum of all the effects producible from it. This remainder of power, it is plain, must be equal to that of the velocity of the wheel itself, multiplied into the weight of the water. In the present experiment, the circumference of the wheel moved with the velocity of 3·123 feet in the second, which answers to a head of 1·82 inches, and this height being multiplied by 264·7, the quantity of water expended in a minute gives 481 for the power of the water after it has passed the wheel; and hence the true proportion betwixt the power and the effect will be as 3849 to 1266, or as 11 to 4. These calculations are founded upon the known maxim in hydrostatics, that the velocity of spouting water is nearly the same with that which a heavy body would acquire by falling from a height equal to that of the reservoir, and is proved by the rising of jets nearly to the height of their reservoirs.

As the wheel revolved eighty-six times in a minute, the velocity of the water must be equal to eighty-six circumferences of the wheel; which, according to the dimensions of the apparatus used by Mr. Smeaton, was as 86 to 30, or as 20 to 7. The greatest load with which the wheel could move was 9 lbs. 6 oz.; and by 12 lbs. it was entirely stopped. Whence our author concludes, that the impulse of the water is more than double of what it ought to be according to theory: but this he accounts for by observing, that in his experiment the wheel was placed not in an open river, where the natural current, after it has communicated its impulse to the float, has room on all sides to escape, as the theory supposes, but in a conduit, to which the float being adapted, the water cannot otherwise escape than by moving along with the wheel. It is observable, that a wheel working in this manner, as soon as the water meets the float, receiving a sudden check, it rises up against the float like a wave against a fixed object; insomuch that, when the sheet of water is not a quarter of an inch thick before the float, yet the sheet will act upon the whole surface of a float whose height is three inches; and consequently, were the float no higher than the thickness of the sheet of water, as the theory also supposes, a great part of the force would be lost by the water dashing over the float.

Mr. Smeaton next proceeds to give tables of the velocities of wheels with different heights of water; and from the whole deduces the following conclusions:—1. The virtual or effective head being the same, the effect will be nearly as the quantity of water expended. 2. The expense of water being the same, the effect will be nearly as the height of the virtual or effective head. 3. The quantity of water expended being the same, the effect is nearly as the square of the velocity. 4. The aperture being the same, the effect will be nearly as the cube of the velocity of the water. Hence, if water passes out of an aperture in the same section, but with different velocities, the expense will be proportional to the velocity; and therefore, if the expense be not proportional to the velocity, the section of the water is not to the same. 5. The virtual head, or that from which we are to calculate the power, bears no proportion to the head of water; but when the aperture is larger, or the velocity of the water less, they approach nearer to a coincidence; and consequently, in the large openings of mills and sluices, where great quantities of water are discharged from moderate heads, the head of water, and the virtual head determined from the velocity, will nearly agree, which is also confirmed by experience. 6. The most general proportion betwixt the power and effect is that of 10 to 3; the extremes 10 to 3·2, and 10 to 2·8. But it is observable that, where the power is greatest, the second term of the ratio is greatest also; whence we may allow the proportion subsisting in great works to be as 3 to 1. 7. The proportion of velocity between the water and wheel is in general about 5 to 2. 8. There is no certain ratio between the load that the wheel will carry at its maximum, and what will totally stop it; though the proportions are contained within the limits of 20 to 19, and 20 to 15; but as the effect approaches nearest to the ratio of 20 to 15, or of 4 to 3 when the power is greatest either by increase of velocity or quantity of water, this seems to be the most applicable to large works; but as the load that a wheel ought to have, in order to work to the best advantage, can be assigned by knowing the effect that it ought to produce, and the velocity it ought to have in producing it, the exact knowledge of the greatest load it will bear is of the least consequence in practice.

Mr. Smeaton, after having finished his experiments on the undershot mills, reduced the number of floats, which were originally 24, to 12; which caused a diminution in the effect, by reason that a greater quantity of water escaped between the floats and the floor than before; but on adapting to it a circular sweep, of such a length that one float entered into the curve before the other left it, the effect came so near that of the former as not to give any hopes of advancing it by increasing the number of floats beyond twenty-four in this particular wheel.

He next proceeds to examine the power of water when acting by its own gravity in turning an overshot wheel: 'in reasoning without experiment,' says he, 'one might be led to imagine that however different the mode of application is, yet whenever the same quantity of water descends through the same perpendicular space, the natural effective power would be equal, supposing the machinery free from friction, equally calculated to receive the full effect of the power, and to make the most of it: for if we suppose the height of a column of water to be thirty inches, and resting upon a base or aperture of

one inch square, every cubic inch of water that departs therefrom will acquire the same velocity or momentum, from the uniform pressure of thirty cubic inches above it, that one cubic inch let fall from the top will acquire in falling down to the level of the aperture; one would therefore suppose that a cubic inch of water, let fall through a space of thirty inches, and there impinging upon another body, would be capable of producing an equal effect by collision, as if the same cubic inch had descended through the same space with a slower motion, and produced its effects gradually. But however conclusive this reasoning may seem, it will appear, in the course of the following deductions, that the effect of the gravity of descending bodies is very different from the effect of the stroke of such as are non-elastic, though generated by an equal mechanical power.

Having made such alterations in his machinery as were necessary for overshot wheels, our author next gives a table of experiments with the apparatus so altered. In these the head was six inches, and the height of the wheel twenty-four inches; so that the whole descent was thirty inches; the quantity of water expended in a minute was 96⅔ lbs.; which, multiplied by thirty inches, gives the power = 2900: and, after making the proper calculations, the effect was computed at 1914; whence the ratio of the power to it comes to be nearly 3 to 2. If, however, we compute the power from the height of the wheel only, the power will be to the effect nearly as 5 to 4.

From another set of experiments the following conclusions were deduced:—

1. The effective power of the water must be reckoned upon the whole descent: because it must be raised to that height in order to be able to produce the same effect a second time. The ratios between the powers so estimated and the effects at a maximum, differ nearly from 4 to 3, and from 4 to 2. Where the heads of water and quantities of it expended are the least, the proportion is nearly from 4 to 3; but, where the heads and quantities are greatest, it comes nearer to that of 4 to 2: so that by a medium of the whole the ratio is nearly as 3 to 2. Hence it appears that the effect of overshot wheels is nearly double to that of undershot ones; the consequence of which is, that non-elastic bodies, when acting by their impulse of collision, communicate only a part of their original impulse, the remainder being spent in changing their figure in consequence of the stroke. The ultimate conclusion is, that the effects as well as the powers are as the quantities of water and perpendicular heights multiplied together respectively.

2. By increasing the head it does not appear that the effects are at all augmented in proportion; for, by raising it from three to eleven inches, the effect was augmented by less than one-seventh of the increase of perpendicular height. Hence it follows, that the higher the wheel is, in proportion to the whole descent, the greater will be the effect; because it depends less upon the impulse of the head, and more upon the gravity of the water in buckets: and, if we consider how obliquely the water issuing from the head must strike the buckets, we shall not be at a loss to account for the little advantage that arises from the impulse thereof, and shall immediately see of how little consequence this is to the effect of an overshot wheel. This however, as well as other things, must be subject to limitation; for it is necessary that the velocity of the water should be somewhat greater than the wheel, otherwise the latter will not only be retarded by the striking of the buckets against the water, but some of the power will be lost by the dashing of the water over the buckets.

3. To determine the velocity which the circumference of the wheel ought to have, in order to produce the greatest effect, Mr. Smeaton observes that the more slowly any body descends by the force of gravity, when acting upon any piece of machinery, the more of that force will be spent upon it, and consequently the effect will be the greater. If a stream of water falls into the bucket of an overshot wheel it will be there retained till the wheel discharges it by moving round, and, of consequence, the slower the wheel moves, the more water it will receive; so that what is lost in velocity is gained by the greater pressure of water upon the buckets. From the experiments, however, it appears that, when the wheel made about twenty turns in a minute, the effect was greatest; when it made only eighteen and a quarter, the motion was irregular; and, when loaded so as not to admit its turning eighteen times, the wheel was overpowered with the load. When it made thirty turns, the power was diminished by about one-twentieth; and, when the number of turns was increased to forty, it was diminished by one-fourth. Hence we see that in practice the velocity of the wheel should not be diminished farther than what will procure some solid advantage in point of power; because, ceteris paribus, the buckets must be larger as the motion is slower; and, the wheel being more loaded with water, the stress will be proportionably increased upon every part of the work. The best velocity for practice therefore will be that when the wheel made thirty turns in a minute, which is little more than three feet in a second. This velocity is applicable to the highest overshot wheels as well as the lowest. Experience however determines, that high wheels may deviate further from this rule before they will lose their power, by a given aliquot part of the whole, than low ones can be permitted to do; for a wheel of twenty-four feet high may move at the rate of six feet per second; while our author has seen one of thirty-three feet high move very steadily and well with a velocity of little more than two feet. The reason of this superior velocity, in the twenty-four feet wheel, may probably be owing to the small proportion that the head requisite to give the proper velocity to the wheel bears to the whole height.

4. The maximum load for an overshot wheel is that which reduces the circumference of the wheel to its proper velocity; which is known by dividing the effect it ought to produce in a given time by the space intended to be described by the circumference of the wheel in the same time: the quotient will be the resistance overcome at the circumference of the wheel, and is equal to

the load required, including the friction and resistance of the machinery.

5. The greatest velocity that an overshot wheel is capable of depends jointly upon the diameter or height of the wheel and the velocity of falling bodies; for it is plain that the velocity of the circumference can never be greater than to describe a semi-circumference, while a body let fall from the top describes the diameter, nor even quite so great; as the difference in point of time must always be in favor of that which falls through the diameter. Thus, supposing the diameter of the wheel to be sixteen feet and an inch in diameter, a heavy body would fall through this space in one second; but such a wheel could never arrive at this velocity, or make one turn in two seconds, nor could an overshot wheel ever come near it; because, after it has acquired a certain velocity, great part of the water is prevented from entering the buckets, and part is thrown out again by the centrifugal force; and, as these circumstances have a considerable dependence upon the form of the buckets, it is impossible to lay down any general rule for the velocity of this kind of wheels.

6. Though in theory we may suppose a wheel to be made capable of overcoming any resistance whatever, yet, as in practice it is necessary to make the wheel and buckets of some certain and determinate size, we always find that the wheel will be stopped by such a weight as is equal to the effort of the water in all the buckets of a semi-circumference put together. This may be determined from the structure of the buckets themselves; but, in practice, an overshot wheel becomes unserviceable long before this time; for, when it meets with such an obstacle as diminishes its velocity to a certain degree, its motion becomes irregular; but this never happens till the velocity of the circumference is less than the two feet per second, when the resistance is equable.

7. From the above observations we may easily deduce the force of water upon breast-wheels, &c. But, in general, all kinds of wheels, where the water cannot descend through a given space unless the wheel moves with it, are to be considered as overshot wheels; and those which receive the impulse or shock of the water, whether in an horizontal, oblique, or perpendicular direction, are to be considered as undershots. Hence a wheel, in which the water strikes at a certain point below the surface of the head, and after that descends in the arch of a circle, pressing by its gravity upon the wheel, the effect of such a wheel will be equal to that of an undershot whose head is equal to the difference of level between the surface of the water in the reservoir and the point where it strikes the wheel, added to that of an overshot whose height is equal to the difference of level between the point where it strikes the wheel and the level of the tail-water.

In the sixty-sixth volume of the Transactions, Mr. Smeaton considers some of the causes which have produced disagreements and disputes among mathematicians upon this subject. He observes, that soon after Sir Isaac Newton had given his definition, 'that the quantity of motion is the measure of the same, arising from the velocity and quantity of matter conjointly,' it was controverted by his contemporary philosophers. They maintained that the measure of the quantity of motion should be estimated by taking the quantity of matter and the square of the velocity conjointly. On this subject he remarks that, from equal impelling powers acting for equal intervals of time, equal augmentations of velocity are acquired by given bodies when they are not resisted by a medium. Thus a body descending one second by the force of gravity, passes through a space of sixteen feet and an inch; but at the end of that time it has acquired a velocity of thirty-two feet two inches in a second; at the end of two seconds it has acquired one that would carry it through sixty-four feet four inches in a second. If, therefore, in consequence of this equal increase of velocity, we define this to be a double quantity of motion generated in a given time in a certain quantity of matter, we come near to Sir Isaac's definition; but, in trying experiments upon the effects of bodies, it appears that when a body is put in motion, by whatever cause, the impression it will make upon an uniformly resisting medium, or upon uniformly yielding substances, will be as the mass of matter of the moving body multiplied by the square of its velocity. The question, therefore, properly is, whether these terms, the quantity of motion, the momenta, or forces, of bodies in motion, are to be esteemed equal, double, or triple, when they have been generated by an equable impulse acting for an equal, double, or triple time? or that it should be measured by the effects being equal, double, or triple, in overcoming resistances before a body in motion can be stopped? For, according to the meaning we put upon these words, the momenta of equal bodies will be as the velocities or squares of the velocities of the moving bodies.

Undershot wheels had been greatly preferred by M. Belidor to those of any other construction. He had even concluded, that water applied in this way will do more than six times the work of an overshot wheel; While Dr. Desaguliers, in overthrowing Belidor's proposition, asserted that an overshot wheel would do ten times the work of an undershot wheel with an equal quantity of water. Between these two celebrated authors, therefore, there is a difference of no less than sixty to one. In consequence of such enormous disagreement, Mr. Smeaton began the experiments above described. From them, besides the positions already deduced, it appears that, where the velocity of water is double, the adjutage or aperture of the sluice remaining the same, the effect is eight times; that is, not as the square, but as the cube of velocity. In the other conclusion of Desaguliers and Maclaurin, the error was no less; for, from thence it would follow, that by means of the wheel only $\frac{4}{27}$ths of the water expended would be raised back again to the height of the reservoir from which it descended, exclusive of the friction, which would still diminish the quantity; but from Mr. Smeaton's experiments it appears that in some cases upwards of one-fourth had been raised. In large works the effects had been still greater, approaching in an undershot wheel to one-half, and in an overshot one to the whole; which

would be the limit, if it were possible to remove the friction and resistance of the air. The velocity of the wheel also, which, according to the conclusions of M. Parent and Dr. Desaguliers, amounted to no more than one-third of the velocity of the water, varies, according to Mr. Smeaton, between one-third and one-half. But in all great works the maximum lies much nearer to one-half than a third; the former appearing to be the true maximum, if all friction, resistance of the air, and scattering of water could be avoided.

To make these matters plain to mechanics, and to prevent them from running into practical errors, in consequence of a fallacious theory, Mr. Smeaton, in the year 1759, instituted another set of experiments; the immediate object of which was to determine what proportion or quantity of mechanical power is expended in giving the same body different degrees of velocity. Having constructed a proper apparatus for the purpose, and with it made a number of experiments, he concludes, 'that time, properly speaking, has nothing to do with the production of mechanical effects, otherwise than as by equally flowing it becomes a common measure; so that whatever mechanical effect is found to be produced in a given time, the uniform continuance of the action of the same mechanical power will in a double time produce twice that effect. A mechanical power, therefore, properly speaking, is measured by the whole of its mechanical effects produced, whether that effect be produced in a greater or less time: thus, having treasured up 1000 tons of water, which I can let out upon the overshot wheel of a mill, and descending through a perpendicular of twenty feet; this power, applied in a proper manner, will grind a certain quantity of corn in an hour: but supposing the mill to be capable of receiving a greater impulse with as great disadvantage as a less; then, if the corn be let out twice as fast, the same quantity of corn will be ground in half an hour, the whole of the water being likewise expended in that time. What time has therefore to do in the case is this: let the rate of doing the business, or producing the effect, be what it will; if this rate is uniform, when I have found by experiment what is done in a given time, then, proceeding at the same rate, twice the effect will be produced in twice the time, on a supposition that I have a supply of mechanic power to go on with. Thus, 1000 tons of water descending through twenty feet perpendicular, being, as has been shown, a given mechanic power, let it be expended at what rate it will; if, when this is expended, we are to wait another hour till an equal quantity can be procured, then we can only expend twelve such quantities in twenty-four hours. But if, while the 1000 tons of water are expending in one hour, the same quantity is renewed, we can then expend twenty-four such in twenty-four hours, or go on without intermission. The product or effect will then be in proportion to time, which is the common measure; but the quantity of mechanic power arising from the flow of the two rivers, compared by taking an equal portion of time, is double in the one to the other; though each has a mill that, when going, will grind an equal quantity of corn in an hour.'

Mr. Ferguson, in his directions to mill-wrights, has adopted the maxim which Mr. Smeaton condemns as erroneous, viz. that, when the velocity of the wheel is but one-third of that of the water, it then acts to the greatest advantage. He adds that the mill-stone ought to make about sixty turns in a minute; for when it makes only forty or fifty turns it grinds too slowly; and, when more than seventy, it heats the meal too much, and cuts the bran so small that a part of it mixes with the meal, and cannot be separated from it by any means. The utmost perfection of millwork, therefore, according to this author, lies in making the train so that the mill-stones shall make about sixty turns in a minute, when the wheel moves with one-third of the velocity of the water. To accomplish this, he lays down the following rules:—1. Measure the perpendicular height of the fall of water above the middle of the aperture, where it is let out to act by impulse against the float-boards on the lower side of the undershot wheel. 2. Multiply this constant number 64·2882 by the height of the fall in feet, and extract the square root of the product, which will give the number of feet that the water moves in a second. 3. The velocity of the floats of the wheel is equal to one-third of the velocity of the water just now found. 4. Divide the circumference of the wheel by the velocity of its floats, and the quotient will be the number of seconds in one turn of the great water wheel, on whose axis the cog-wheel that turns the trundle is fixed. 5. Divide sixty by the number of seconds in a turn of the water-wheel, and the quotient will be the number of turns it makes in a minute. 6. By this number of turns divide sixty, the number of turns that a mill-stone ought to have in a minute; the quotient is the number of turns that the mill-stone ought to make for every one of the large wheel. 7. Then, as the number of turns required of the mill-stone in a minute is to the number of turns of the cog-wheel in a minute; so must the number of cogs in the wheel be to the number of staves in the trundle on the axis of the mill-stone, in the nearest whole number that can be found. On these principles Mr. Ferguson has constructed the following table, for the sake of such as have occasion to construct mills, and are not willing or able to make particular calculations:—

Height of the fall of water.	Velocity of the fall of water per second.		Velocity of the wheel per second.		Revolutions of the wheel per minute.		Revolutions of the mill-stone for one of the wheel.		Cogs in the wheel, and staves in the trundle.		Revolutions of the mill-stone per minute, by these staves and cogs.	
Feet.	Feet.	100 parts of a foot.	Feet.	100 parts of a foot.	Revolutions	100 parts of a rev.	Revolutions	100 parts of a rev.	Cogs.	Staves.	Revolutions	100 parts of a rev.
1	8	02	2	67	2	83	42	40	254	6	119	84
2	11	34	3	78	4	00	30	00	210	7	120	00
3	13	89	4	63	4	91	24	44	196	8	120	28
4	16	04	5	35	5	67	21	16	190	9	119	74
5	17	93	5	98	6	34	18	92	170	9	119	68
6	19	64	6	55	6	94	17	28	156	9	120	20
7	21	21	7	07	7	50	16	00	144	9	120	00
8	22	68	7	56	8	02	14	96	134	9	119	34
9	24	05	8	02	8	51	14	10	140	10	119	14
10	25	35	8	45	8	97	13	38	134	10	120	18
11	26	59	8	86	9	40	12	76	128	10	120	32
12	27	77	9	26	9	82	12	22	122	10	119	80
13	28	91	9	64	10	22	11	74	118	10	120	36
14	30	00	10	00	10	60	11	32	112	10	118	72
15	31	05	10	35	10	99	10	92	110	10	120	96
16	32	07	10	09	11	34	10	58	106	10	120	20
17	33	06	11	02	11	70	10	26	102	10	119	34
18	34	02	11	34	12	02	9	98	100	10	120	20
19	34	95	11	65	12	37	9	70	98	10	121	22
20	35	86	11	95	12	68	9	46	94	10	119	18
1	2		3		4		5		6		7	

For the practical construction of water mills, Mr. Imison has laid down the following rules. To find the velocity or force of any moderate stream of water; let it be obstructed by a dam, in such a manner as to force the whole stream into a spout, by which it may be conveyed into a large vessel or reservoir. Measure then the quantity of water which falls into the reservoir in one second or minute; and, multiplying by the number of seconds or minutes in an hour, we have the whole force of the stream of water per hour. In streams which are too large to be measured in this way the velocity is determined (though, we must own, in a vague manner) by that of straw or other light body floating down it; and calculations may be made accordingly. Mr. Imison differs materially from Mr. Ferguson in the number of revolutions which a mill-stone ought to make in a minute; the latter being of opinion that sixty revolutions of a mill-stone in a minute are sufficient, while Mr. Imison requires 120; though he agrees with him that the velocity of the wheel should be only one-third of that of the water. The mill-stone, according to Mr. Ferguson, ought to be five feet in diameter; but Mr. Imison makes it only four feet and a half.

To construct a mill by this table, find the height of the fall of water in the first column, and against that height, in the sixth column, you have the number of cogs in the wheel, and staves in the trundle, for causing the mill-stone, four feet six inches diameter, to make about 120 revolutions in a minute, as nearly as possible, when the wheel goes with one-third part of the velocity of the water. And it appears, by the seventh column, that the number of cogs in the wheel and staves in the trundle are so near the truth for the required purpose, that the least number of revolutions of the mill-stone in a minute is 118, and the greatest number never exceeds 121; which, according to our author, is the velocity of the best mills he had seen.

With regard to the mere mechanical part, our author observes, that an overshot wheel acts with greater power than a breast or undershot wheel; so that where there is a considerable descent, and only a small quantity of water, the overshot wheel ought always to be made use of. Where the water runs only upon a little declivity, it can act but slowly upon the under part of the wheel; in which case the motion of the wheel will be very slow: the float boards therefore ought to be very long, though not high, that a large body of water may act upon them; so that what is wanting in velocity may be made up in power: in which case the cog-wheel may have a greater number of cogs, in proportion to the staves of the trundle, in order to give the mill-stone a sufficient degree of velocity.

In the construction of wind-mills Mr. Smeaton has been at no less pains to explain the principles than in those which go by water. For this purpose he constructed a machine, of which a particular description was given in the fifty-first volume of the Philosophical Transactions. The general principle of this was, that by means of a determinate weight it carried round an axis with a horizontal arm, upon which were four small

moveable sails. Thus the sails met with a constant and equable blast of air; and, as they moved round, a string with a weight affixed to it was wound about their axis, and thus showed what kind of size or construction of sails answered the purpose best. With this machine a great number of experiments were made; the results of which were as follows:—

1. The sails set at the angle with the axis, proposed as the best by M. Parent and other geometricians, viz. 55°, was found to be the worst proportion of any that were tried.

2. When the angle of the sails with the axis was increased from 72° to 75°, the power was augmented in the proportion of 32 to 45; and this is the angle most commonly in use when the sails are planes.

3. Were nothing more requisite than to cause the sails to acquire a certain degree of velocity by the wind, the position recommended by M. Parent would be the best. But if the sails are intended, with given dimensions, to produce the greatest effects possible in a given time, we must, if planes are made use of, confine our angle within the limits of 72° and 75°.

4. The variation of a degree or two, when the angle is near the best, is but of little consequence.

5. When the wind falls upon concave sails, it is an advantage to the power of the whole, though each part separately taken should not be disposed of to the best advantage.

6. From several experiments, on a large scale, Mr. Smeaton has found the following angles to answer as well as any. The radius is supposed to be divided into six parts and one-sixth, reckoning from the centre, and is called 1, the extremity being denoted 6:

No.	Angle with that Axis.	Angle with the Plane of Motion.
1	72°	18°
2	71	19
3	72	18 middle
4	74	16
5	77½	12½
6	83	7 extremity.

7. Having thus obtained the best method of weathering the sails, i. e. the most advantageous manner in which they can be placed, our author's next care was to try what advantage could be derived from an increase of surface upon the same radius. The result was, that a broader sail requires a large angle; and, when the sail is broader at the extremity than near the centre, the figure is more advantageous than that of a parallelogram. The figure and proportion of enlarged sails, which our author determines to be the most advantageous on a large scale, is that where the extreme bar is one-third of the radius or whip (as the workmen call it), and is divided by the whip in the proportion of 3 to 5. The triangular or loading sail is covered with board from the point downward of its height, the rest as usual with cloth. The angles abovementioned are likewise the most proper for enlarged sails; it being found in practice that the sails should rather be too little than too much exposed to the direct action of the wind.

Some have imagined that the more sail the greater would be the power of the windmill, and have therefore proposed to fill up the whole area; and by making each sail a sector of an ellipsis, according to M. Parent's method, to intercept the whole cylinder of wind, in order to produce the greatest effect possible. From our author's experiments, however, it appeared, that when the surface of the sail exceeded seven-eighths of the area, the effect was rather diminished than augmented. Hence he concludes that, when the whole cylinder of wind is intercepted, it cannot then produce the greatest effect, for want of proper interstices to escape. 'It is certainly desirable,' says Mr. Smeaton, 'that the sails of windmills should be as short as possible; but it is equally desirable that the quantity of cloth should be the least that may be, to avoid damage by sudden squalls of wind. The best structure, therefore, for large mills, is that where the quantity of cloth is the greatest that can be in a given circle; on this condition, that the effect holds out in proportion to the quantity of cloth; for otherwise the effect can be augmented in a given degree by a less increase of cloth, upon a larger radius, than would be required if the cloth was increased upon the same radius.'

8. The ratios between the velocities of windmill sails unloaded, and when loaded to their maximum, turned out very different in different experiments, but the most common proportion was 3 to 2. In general it happened, that where the power was greatest, whether by enlargement of the surface of the sails, or an increased velocity of the wind, the second term of the ratio was diminished.

9. The ratios between the least load that would stop the sails, and the maximum with which they would turn, were confined betwixt that of 10 to 8 and 10 to 9; being at a medium about 10 to 8·3, and 10 to 9, or about 6 to 5; though, on the whole, it appeared that, where the angle of the sails or quantity of cloth was greatest, the second term of the ratio was less.

10. The velocity of wind-mill sails, whether unloaded or loaded, so as to produce a maximum, is nearly as the velocity of the wind, their shape and position being the same. On this subject Mr. Ferguson remarks, that it is almost incredible to think with what velocity the tips of the sails move when acted upon by a moderate wind. He has several times counted the number of revolutions made by the sails in ten or fifteen minutes; and, from the length of the arms from tip to tip, has computed that if a hoop of the same size was to run upon plain ground with an equal velocity, it would go upwards of thirty miles in an hour.

11. The load at the maximum is nearly, but somewhat less, than as the square of the velocity of the wind; the shape and position of the sails being the same.

12. The effects of the same sails at a maximum are nearly, but somewhat less than, as the cubes of the velocity of the wind.

13. The load of the same sails at a maximum

is nearly as the squares, and the effect as the cubes of their number of turns in a given time.

14. When sails are loaded so as to produce a maximum at a given velocity, and the velocity of the wind increases, the load continuing the same; then the increase of effect, when the increase of the velocity of the wind is small, will be nearly as the squares of these velocities; but, when the velocity of the wind is double, the effects will be nearly as 10 to 27½; and, when the velocities compared are more than double of that where the given load produces a maximum, the effects increase nearly in a simple ratio of the velocity of the wind. Hence our author concludes that wind-mills, such as the different species for draining water, &c., lose much of their effect by acting against one invariable opposition.

15. In sails of a similar figure and position the number of turns in a given time will be reciprocally as the radius or length of the sail.

16. The load, at a maximum, that sails of a similar figure and position will overcome, at a given distance from the centre of motion, will be as the cube of the radius.

17. The effects of sails of similar position and figure are as the square of the radius. Hence, augmenting the length of the sail, without augmenting the quantity of cloth, does not increase the power; because what is gained by the length of the lever is lost by the slowness of the motion. Hence also, if the sails are increased in length, the breadth remaining the same, the effect will be as the radius.

18. The velocity of the extremity of the Dutch sails, as well as of the enlarged sails, either unloaded, or even when loaded to a maximum, is considerably greater than that of the wind itself. This appears plainly from the observations of Mr. Ferguson, already quoted, concerning the velocity of sails.

19. From many observations of the comparative effects of sails of various kinds, Mr. Smeaton concludes that the enlarged sails are superior to those of the Dutch construction.

Having thus discussed the subject of the common wind-mills with oblique vanes, Mr. Smeaton next proceeds to the consideration of those called horizontal wind-mills, in which it is attempted to make the wind impinge directly upon the wheel, as in the case of water-mills. To set the probable advantage of this scheme in its proper point of view, Mr. S. proceeds in the following manner:—'Let A B, fig. 6, be the section of a plane, in which let the wind blow in the direction C D, with such a velocity as to describe a given space, B E, in a given time, suppose one second; and let A B be moved parallel to itself in the direction C D. Now if the plane A B moves with the same velocity as the wind; that is, if the point B moves through the space B E in the same time that a particle of air would move through it, it is plain that in this case there can be no pressure or impulse of the wind upon the plane; but if the plane moves slower than the wind, so that the point B may move to F, while a particle of air setting out from B would reach E, then B F will express the velocity of the plane; and the relative velocity of the wind and plane would be expressed by the line F E. Let the ratio of F E to B E be given, suppose 2 to 3; let the line A B represent the impulse of the wind upon the plane A B when acting with its whole velocity B E; but, when acting with its relative velocity F E, let its impulse be denoted by some aliquot part of A B, as for instance $\frac{4}{9}$; then will $\frac{4}{9}$ths of the parallelogram A F represent the mechanical power of the plane, that is, $\frac{4}{9}$th A B × $\frac{1}{3}$ B E. Let I N be the section of a plane inclined in such a manner that the base I K of the right-angled triangle I K N may be equal to A B, and the perpendicular N K = B E: let the plane I N be struck by the wind in the direction L M, perpendicular to I K; then, according to the known rules of oblique forces, the impulse of the wind upon the plane I N, tending to move it according to the direction L M or N K, will be denoted by the base I K; and that part of the impulse tending to move it, according to the direction I K, will be expressed by the perpendicular N K. Let the plane I N be moveable in the direction of I K only; that is, the point I in the direction of I K, and the point N in the direction N Q, parallel thereto. Now it is evident that, if the point I moves through the line I K, while a particle of air, setting forwards at the same time from the point N, moves through the line N K, they will both arrive at the point K at the same time; and consequently there can be no pressure or impulse of the particle of air upon the plane I N. Now let I O be to I K as B F to B E; and let the plane I N move at such a rate that the point I may arrive at O, and acquire the position O Q, in the same time that a particle of air would move through the space N K; as O Q is parallel to I N, by the properties of similar triangles it will cut N K in the point P in such a manner that N P will be equal to B F, and P K to F E. Hence it appears that the plane I N, by acquiring the position O Q, withdraws itself from the action of the wind, by the same space N P that the plane A B does by acquiring the position F G; and consequently, from the equality of P K to F E, the relative impulse of the wind P K upon the plane O Q will be equal to the relative impulse of the wind upon the plane F G; and since the impulse of the wind upon A B, with the relative velocity F E, in the direction B E, is represented by $\frac{4}{9}$ A B; the relative impulse of the wind upon the plane I N in the direction N K will, in like manner, be represented by $\frac{4}{9}$ I K; and the impulse of the wind upon the plane I N, with the relative velocity P K in the direction I K, will be represented by $\frac{4}{9}$ N K: and consequently the mechanical power of the plane in the direction I K will be represented by $\frac{4}{9}$ of the parallelogram I Q: that is, $\frac{1}{3}$ I K × $\frac{4}{9}$ N K: that is, from the equality of I K to A B, and N K to B E, we shall have $\frac{4}{9}$ I Q = $\frac{1}{3}$ A B × $\frac{4}{9}$ B E = $\frac{4}{9}$ A B × $\frac{1}{3}$ B E = $\frac{4}{27}$, the area of the parallelogram A F.

'Hence we deduce this general proposition, that all planes, however situated, that intercept the same section of the wind, and have the same relative velocity in regard to the wind, when reduced into the same direction, have equal powers to produce the same mechanical effects. For what is lost by the obliquity of the

impulse is gained by the velocity of the motion. Hence it appears that an oblique sail is under no disadvantage in respect of power, compared with a direct one; except what arises from a diminution of its breadth, in regard to the section of the wind; the breadth I N being by obliquity reduced to I K.

'The disadvantage of horizontal wind-mills, therefore, does not consist in this, that each sail, when directly exposed to the wind, is capable of a less power than an oblique one of the same dimensions; but that, in a horizontal wind-mill, little more than one sail can be acting at once: whereas, in the common wind-mill, all the four act together; and therefore, supposing each vane of a horizontal wind-mill to be of the same size with that of a vertical one, it is manifest that the power of a vertical mill will be four times as great as that of a horizontal one, let the number of vanes be what we will. This disadvantage arises from the nature of the thing; but if we consider the further disadvantage that arises from the difficulty of getting the sails back again against the wind, &c., we need not wonder if this kind of mill is in reality found to have not above one-eighth or one-tenth of the power of the common sort: as has appeared in some attempts of this kind.'

The regulation of the velocity of a mill is a matter of very great importance to preserve a uniformity of motion, either when the force of the first mover is fluctuating, or when the resistance, or work of the mill, varies in its degree: either or both of these causes will occasion the mill to accelerate or diminish its velocity; and in many instances it will have a very injurious effect upon the operations of the mill. Thus, in a mill for spinning cotton, wool, flax, &c., driven by a water-wheel, are a multiplicity of movements, many of which are occasionally disengaged, in different parts of the mill, for various purposes. This tends to diminish the resistance to the first mover, and the whole mill accelerates. Or, on the other hand, the head of water, which drives the wheel, may be liable to rise and fall suddenly, from many causes to which great and rapid rivers are subject, and cause similar irregularities in the speed of the wheel. For such cases judicious mechanics have adopted contrivances, or regulators, which counteract all these causes of irregularity; and a large mill, so regulated, will move like a clock, with regard to its regularity of velocity. These regulators are usually called governors, the application of which is most conspicuous in the steam engine, when that machine is applied to manufacturing purposes.

Let A B, fig. 7, be a vertical axis, which is made to revolve by the bevelled wheel A, acted on by the other parts of the machinery, and so that it always revolves with a velocity proportional to that of the fly-wheel. Two heavy balls C C′ are attached to metal rods, which work on a pivot at B, so that they are capable of receding from the axis A B. As they recede from the axis, the joints D D′ recede from one another, and the joint E is drawn down. This joint E is connected with the end of a lever, or a system of levers, the action of which we shall presently explain.

Now, by the revolution of the spindle or axis A B, the balls C C′ acquire an obvious tendency to fly off from the axis, and this tendency is resisted by their weight; so that, when the instrument is revolving with a certain velocity, the balls will remain suspended. The property from which this apparatus derives its whole efficacy is, that at whatever distance or in whatever position the balls remain suspended, and neither move to or from the axis, the spindle A B must be revolving with the same velocity. A greater velocity would cause the balls to fly, and a less velocity would cause them to fall towards the axis.

If the action of the levers with which the joint E is connected be directed upon the first mover in such a manner that its energy is diminished when E is depressed, and increased when E is elevated, it is plain that the uniformity of velocity which is sought may be obtained. Let us suppose that the levers on which E works communicate with a valve which admits steam to the piston of a steam-engine to which this governor is applied; and suppose that, when E is raised, and the balls C C′ rest in their seats, the valve is fully open, so as to allow the steam to flow in a full stream to the piston; but that according as E is depressed the levers gradually close the valve, so as to admit the steam in a constantly diminished quantity. Now suppose that the engine has been working twenty printing presses, and that the action of ten of them is suddenly suspended. The engine thus loses half its load, and would, if the same power of steam continued to be admitted, move with about twice its former velocity. But the moment an increased velocity is perceived in the machine, the balls C C′ recede from the axis, draw down the joint E, partially close the valve, and check the supply of steam to the cylinder. The impelling power is thus diminished; and, if it be diminished in exactly the same degree as the load, the machine will move with its former velocity; but if it should, at first, be more diminished, the velocity will be less than its former velocity, and the balls will again move towards the axis and open the valve, and will, at length, settle into that position in which the steam admitted to the cylinder is exactly proportioned to the load on the machine; and the proper velocity will thus be restored.

In the employment of machinery, it is evidently of great importance to be provided with an easy and ready method for discovering at all times whether the motion of the machine is quicker or slower than what is known to be best adapted for the object in view. This advantage is derived from the tachometer, an instrument contrived by Mr. Donken, for which he was rewarded by the Society for the Encouragement of Arts, &c., with their gold medal.

A front view of the tachometer is represented in fig. 8, and a side view in fig. 9. X Y Z, fig. 8, is the vertical section of a wooden cup, made of box, which is drawn in elevation at fig. 9. The whiter parts of the section in fig. 8 represent what is solid, and the dark parts what is hollow. This cup is filled with mercury up to the level L I., fig. 8. Into the mercury is immersed the lower part of the upright glass tube

A B, which is filled with colored spirits of wine, and open at both ends, so that some of the mercury in the cup enters at the lower orifice, and, when every thing is at rest, supports a long column of spirits, as represented in the figure. The bottom of the cup is fastened by a screw to a short vertical spindle D; so that, when the spindle is whirled round, the cup, whose figure is a solid of revolution, revolves at the same time round its axis, which coincides with that of the spindle.

In consequence of this rotation, the mercury in the cup acquires a centrifugal force, by which its particles are thrown outwards, and that with the greater intensity, accordingly as they are more distant from the axis, and according as the angular velocity is greater. Hence, on account of its fluidity, the mercury rises higher and higher as it recedes from the axis, and consequently sinks in the middle of the cup; this elevation at the sides and consequent depression in the middle increasing always with the velocity of rotation. Now the mercury in the tube, though it does not revolve with the cup, cannot continue higher than the mercury immediately surrounding it, nor indeed so high, on account of the superincumbent column of spirits. Thus the mercury in the tube will sink, and consequently the spirits also; but, as that part of the tube which is within the cup is much wider than the part above it, the depression of the spirits will be much greater than that of the mercury, being in the same proportion in which the square of the larger diameter exceeds the square of the smaller.

Let us now suppose, that, by means of a cord passing round a small pulley F, and the wheel G, or in any other convenient way, the spindle D is connected with the machine whose velocity is to be ascertained. In forming this connexion we must be careful to arrange matters so that, when the machine is moving at its quickest rate, the angular velocity of the cup shall not be so great as to depress the spirits below C into the wider part of the tube. We are also, as in the figure, to have a scale of inches and tenths applied to A C, the upper and narrower part of the tube, the numeration being carried downwards from zero, which is to be placed at the point to which the column of spirits rises when the cup is at rest.

Then the instrument will be adjusted if we mark on the scale the point to which the column of spirits is depressed, when the machine is moving with the velocity required. But as in many cases, and particularly in steam-engines, there is a continued oscillation of velocity, in those cases we have to notice the two points between which the column oscillates during the most advantageous movement of the machine.

Here it is proper to observe that the height of the column of spirits will vary with the temperature, when other circumstances are the same. On this account the scale ought to be moveable, so that, by slipping it upwards or downwards, the zero may be placed at the point to which the column reaches when the cup is at rest; and thus the instrument may be adjusted to the particular temperature with the utmost facility, and with sufficient precision. The essential parts of the tachometer have now been mentioned, as well as the method of adjustment, but certain circumstances remain to be stated.

The form of the cup is adapted to render a smaller quantity of mercury sufficient than what must have been employed either with a cylindrical or hemispherical vessel. In every case two precautions are necessary to be observed:—First that, when the cup is revolving with its greatest velocity, the mercury in the middle shall not sink so low as to allow any of the spirits in the tube to escape from the lower orifice, and that the mercury, when most distant from the axis, shall not be thrown out of the cup. Secondly, that, when the cup is at rest, the mercury shall rise so high above the lower end of the tube that it may support a column of spirits of the proper length.

Now in order that the quantity of mercury, consistent with these conditions, may be reduced to its minimum, it is necessary, first, that if M M, fig. 8, is the level of the mercury at the axis when the cup is revolving with the greatest velocity, the upper part, M M X Y, of the cup should be of such a form as to have the sides covered only with a thin film of the fluid; and, secondly, that, for the purpose of raising the small quantity of mercury to the level L L, which may support a proper height of spirits when the cup is at rest, the cavity of the cup should be in a great measure occupied by the block K K, having a cylindrical perforation in the middle of it for the immersion of the tube, and leaving sufficient room within and around it for the mercury to move freely both along the sides of the tube and of the vessel.

The block K K is preserved in its proper position in the cup or vessel X Y Z, by means of three narrow projecting slips or ribs placed at equal distances round it, and is kept from rising or floating upon the mercury by two or three small iron or steel pins inserted into the under side of the cover, near the aperture through which the tube passes.

It would be extremely difficult, however, nor is it by any means important, to give to the cup the exact form which would reduce the quantity of mercury to its minimum; but we shall have a sufficient approximation, which may be executed with great precision, if the part of the cup above M M is made a parabolic conoid, the vertex of the generating parabola being at that point of the axis to which the mercury sinks at its lowest depression, and the dimensions of the parabola being determined in the following manner:—Let V, G, fig. 11, represent the axis of the cup, and V the point to which the mercury sinks at its lowest depression; at any point G above V draw G H perpendicular to V G; let n be the number of revolutions which the cup is to perform in 1″ at its quickest motion; let v be the number of inches which a body would describe uniformly in 1″, with the velocity required in falling from the rest, through a height equal to G V, and make $G H = \frac{v}{3\ 14\ n}$. Then the parabola to be determined is that which has v for its vertex, V G for its axis, and G H

for its ordinate at G. The cup has a lid to prevent the mercury from being thrown out of it, an event which would take place with a very moderate velocity of rotation, unless the sides were raised to an inconvenient height; but the lid, by obstructing the elevation at the sides of the cup, will diminish the depression in the middle, and consequently the depression of spirits in the tube: on this account a cavity is formed in the block, immediately above the level L L, where the mercury stands when the cup is at rest; and thus a receptacle is given to the fluid which would otherwise disturb the centrifugal force, and impair the sensibility of the instrument.

It will be observed, that the lower orifice of the tube is turned upwards. By this means, after the tube has been filled with spirits by suction, and its upper orifice stopped with the finger, it may easily be conveyed to the cup and immersed in the quicksilver, without any danger of the spirits escaping, a circumstance which otherwise it would be extremely difficult to prevent, since no part of the tube can be made capillary, consistently with that free passage to the fluids which is essentially necessary to the operation of the instrument.

We have next to attend to the method of putting the tachometer in motion whenever we wish to examine the velocity of the machine. The pulley F, which is continually whirling during the motion of the machine, has no connexion whatever with the cup, so long as the lever Q R is left to itself. But, when this lever is raised, the hollow cone P, which is attached to the pulley and whirls along with it, is also raised, and, embracing a solid cone on the spindle of the cup, communicates the rotation by friction. When our observation is made we have only to allow the lever to drop by its own weight, and the two cones will be disengaged and the cup remain at rest.

The lever Q R is connected by a vertical rod to another lever S, having, at the extremity S, a valve, which when the lever Q R is raised, and the tachometer is in motion, is lifted up from the top of the tube so as to admit the external air upon the depression of the spirits; on the other hand, when the lever Q R falls, and the cup is at rest, the valve at S closes the tube and prevents the spirits from being wasted by evaporation.

It is, lastly, to be remarked that both the sensibility and the range of the instrument may be infinitely increased; for, on the one hand, by enlarging the proportion between the diameters of the wide and narrow parts of the tube, we enlarge in a much higher proportion the extent of scale corresponding to any given variation of velocity; and on the other hand, by deepening the cup, so as to admit when it is at rest a greater height of mercury above the lower end of the tube, we lengthen the column of spirits which the mercury can support, and consequently enlarge the velocity which, with any given sensibility of the instrument, is requisite to depress the spirits to the bottom of the scale. Hence the tachometer is capable of being employed in very delicate philosophical experiments, more especially as a scale might be applied to it, indicating equal increments of velocity. But in the present account it is merely intended to state how it may be adapted to detect in machinery every deviation from the most advantageous movement.

MILLAR (John), LL.D., professor of civil law in the university of Glasgow, was born in the parish of Shotts, in Lanarkshire, in 1735. He was admitted a member of the faculty of advocates in 1760; and appointed professor in 1761. In 1771 he published a small work entitled Observations concerning the Ranks in Society; which passed through several editions in Britain, and acquired such celebrity on the continent, that M. Garat translated it into French. In 1787 he published An Historical View of the English Constitution; from the settlement of the Saxons in Britain to the accession of the house of Stuart. But it was chiefly as a public lecturer on law that Mr. Millar's talents were useful to his contemporaries. From his lectures on law and government, many of the first characters of the present age imbibed the rudiments of political science, and received the first impressions of attachment to freedom. He died in Glasgow, in June 1801. He was married and had several children.

MILLEDGVILLE, a town of the United States, in Baldwin county, Georgia, the seat of the state government. It is situated in the Oconee, 300 miles, by the river, from the sea, and was founded in 1806. It contains a state-house, court-house, jail, and various other public buildings. Two weekly newspapers are published here. Population 2000: 160 miles W. N.W. of Savannah.

MIL'LENARY, *adj.*
MILLENA'RIAN, *n. s.* & *adj.*
MIL'LENNIST,
MILLEN'NIUM,
MILLEN'NIAL, *adj.*
MILLES'IMAL.

Fr. *millenaire; millenarius*, Lat. Consisting of a thousand: a millenarian, or millennist, is one who expects the millennium; which is taken theologically for the reign of a thousand years, which our Saviour is expected to exercise hereafter upon earth: millennial is, pertaining to the millennium: millesimal is thousandth, consisting of thousandth parts.

Now if there be any other amongst those sixty-five places alledged by Alstedius, wherein the favourers of the *millenarian* reign can place any confidence for the evicting of their opinions, I should be glad to see it driven up to the head. *Bp. Hall.*

There is no passage in the whole book of God, wherein this *millenary* reign of saints is punctually expressed, save only this of the Revelation. *Id.*

For, besides that the *millenary* opinion is expressly taught by Papias, Justyn Martyr, and divers others famous in their time: Justin Martyr in his dialogue against Tryphon says it was the belief of all Christians exactly orthodox. *Jer. Taylor.*

We must give a full account of that state called the *millennium*. *Burnet's Theory of the Earth.*

To be kings and priests unto God, is the charac-

teristic of those that are to enjoy the *milennial* happiness. *Burnet.*

The *millennary* sestertium, in good manuscripts, is marked with a line across the top thus HS.

Arbuthnot on Coins.

To give the square root of the number two, he labored long in *millesimal* fractions, till he confessed there was no end. *Watts.*

MILLENNIUM. A thousand years; generally signifying the 1000 years during which, according to an ancient tradition in the church, grounded on a text in the Apocalypse, our Saviour is to reign with the faithful upon earth after the resurrection, before the final completion of beatitude.

MILLENNIUM is derived from mille anni, 1000 years. Though there has been no age of the church in which the millennium was not admitted by individual divines of the first eminence, yet it is evident from the writings of Eusebius, Irenæus, Origen, and others, among the ancients, as well as from the histories of Dupin, Mosheim, and all the moderns, that it was never adopted by the whole church, or made an article of the established creed in any nation. About the middle of the fourth century, the Millenarians held the following tenets: 1st, That the city of Jerusalem shall be rebuilt, and that the land of Judea shall be the habitation of those who are to reign on earth 1000 years. 2dly, That the first resurrection is not to be confined to the martyrs; but that after the fall of antichrist all the just are to rise, and all that are then on the earth are to continue for that space of time. 3rdly, That Christ shall then come down from heaven, and be seen on earth, and reign there with his servants. 4thly, That the saints, during this period, shall enjoy all the delights of a terrestrial paradise. These opinions were founded upon several passages of Scripture, which the millenarians among the fathers understood in a literal sense, but which the moderns, who hold that opinion, consider as partly literal and partly metaphorical. Of these passages, that upon which the greatest stress has been laid is in Rev. xx. 1—6. Most modern critics contend that the prophecies of the millennium point, not to a resurrection of martyrs and other just men to reign with Christ 1000 years in a visible kingdom upon earth, but to that state of the Christian church which, for 1000 years before the general judgment, will be so pure and so widely extended, that, when compared with the state of the world in the ages preceding, it may be called a resurrection from the dead.

Such is a brief and fair historical view of this question. In modern times the extended circulation of the Scriptures has brought this, in common with every other topic of God's word, into more frequent consideration: able men have espoused the opinions of the old millenarians; while some have advocated a theory that seems to involve two millennia; and others (the most modern expounders of the subject), connect the millennium with the immediate return of the Jews to Palestine, and an exclusive exaltation of that people, under the personal reign of the Messiah, over all the nations of the earth. The most common modern opinion confines all the predictions respecting what has been called the millennium to a spiritual reign of Christ by means of the universal reception of the gospel, and has been thus stated:—1. That the Scriptures afford us ground to believe that the church will arrive to a state of prosperity which it never has yet enjoyed, Rev. xx. 4, 7.; Psal. lxxii. 11; Isa. ii. 2, 4; xi. 9; xlix. 23; lx.; Dan. vii. 27 2. That this will continue at least 1000 years, or a considerable space of time, in which the work of salvation may be fully accomplished in the utmost extent and glory of it. In this time, in which the world will be filled with real Christians, and continue full by constant propagation to supply the place of those who leave the world, there will be many thousands born and live on the earth, to each one that has been born and lived in the preceding 6000 years; so that, if they who shall be born in that 1000 years shall be all, or most of them, saved (as they will be), there will, on the whole, be many thousands of mankind saved to one that shall be lost. 3. This will be a state of great happiness and glory. While some think that Christ will reign personally on earth, and that there will be a literal resurrection of the saints, Rev. xx. 4, 7, these writers suppose that the reign of Christ and resurrection of saints alluded to in that passage, are only figurative; and that nothing more is meant than that, before the general judgment, the Jews shall be converted, genuine Christianity be diffused through all nations, and that Christ shall reign, by his spiritual presence, in a glorious manner. It will, however, be a time of eminent holiness, clear light and knowledge, love, peace, and friendship, agreement in doctrine and worship. Human life, perhaps, will rarely be endangered by the poisons of the mineral, vegetable, and animal kingdoms. Beasts of prey, perhaps, will be extirpated, or tamed by the power of man. The inhabitants of every place will rest secure from fear of robbery and murder. War shall be entirely ended. Capital crimes and punishments be heard of no more. Governments placed on fair, just, and humane foundations. The torch of civil discord will be extinguished. Perhaps Pagans, Turks, Deists, and Jews will be as few in number as Christians are now. Kings, nobles, magistrates, and rulers in churches shall act with principle, and be forward to promote the best interests of men: tyranny, oppression, persecution, bigotry, and cruelty, shall cease. Business will be attended to without contention, dishonesty, and covetousness. Merchandise between distant countries will be conducted without fear of an enemy. Learning, which has always flourished in proportion as religion has spread, shall then greatly increase, and be employed for the best of purposes. Above all, the Bible will be more highly appreciated, its harmony perceived, its superiority owned, and its energy felt by millions of human beings. In fact, 'the earth shall be filled with the knowledge of the Lord as the waters cover the sea.' 4. The time when this millennium will commence cannot be fully ascertained; but the common idea is, that it will be in the 7000th year of the world. It will, most probably come on by degrees, and be in a manner intro-

duced years before that time. The overthrow which popery has had in places where it has been so dominant for hundreds of years seems to prepare for it; the fulfilment of prophecy respecting infidels, and the falling away of many in the last times; and yet, in the midst of all, the number of missionaries sent into different parts of the world, together with the increase of gospel ministers; the thousands of ignorant children that have been taught to read the Bible, and the vast number of different societies that have been instituted for the benevolent purpose of informing the minds and impressing the hearts of the ignorant.— See *Hopkins on the Millennium; Whitby's Treatise on it, at the end of the second volume of his Annotations on the New Testament; Bishop Newton's Twenty-fifth Dissertation on the Prophecies; Bellamy's Treatise on the Millennium, &c.*

Dr. Gill is an advocate for both a spiritual and a personal future reign of Christ on earth. Considering the antichrist of John and the 'man of sin' of St. Paul, as identical, he observes that, of the latter, it is said he shall be consumed by the spirit of' Christ's 'mouth,' which is the preaching of the gospel: this, he conceives will bring on the period of the 'fulness of the gentiles' when the Jews shall be converted (popery having been destroyed): that they shall then join themselves every where, and, as it were, simultaneously to Christian churches: when 'they will return to their own land and possess it, being assisted by the Protestant princes, who will drive out the Turk.' Afterwards he expects the large conversions to God mentioned Isa. lx.; and that the interest and church of Christ will 'make the greatest figure it ever did in the world.'

To this, nearly similar with the foregoing view of Christ's spiritual reign, he adds, as his opinion, that 'Christ will have a special, peculiar, glorious, and visible, kingdom' on earth immediately succeeding his second coming, and the resurrection of all deceased believers: he understands, therefore, literally the former part of Rev. xx. and St. Paul in 1 Thess. iv.

But the most remarkable of modern opinions on this subject, and one worth recording, perhaps, that events may testify to its truth or error, is that so warmly espoused of late by several evangelical clergymen of the church of England and the Rev. Mr. Irving. The latter has, at least, made himself intelligible on this subject; and protests that he is greatly afflicted because of the present unawakened and even dead condition of all the churches with respect to the coming of our Lord Jesus Christ, which is, as he believes, 'close at hand.' He thus delivers his judgment on the subject.

1. 'That the present visible church of the Gentiles, which hath been the depository of the oracles and the sacraments, and the ordinances, since the Jewish state was dissolved, I mean the mixed multitude who are baptised in the name of the Father, and the Son, and the Holy Ghost, under that seal including Protestants, Roman Catholics, Greek church, Armenians, &c., and all the sects of each, as Scottish, English, Irish, Lutheran and Calvinistic churches, with the dissenters and seceders from each, that this body of baptised men, which I call the Gentile church, who should every one of them have been a saint; being 'by baptism ingrafted into Christ Jesus to be made partakers of his justice, whereby our sins are covered and remitted;' standeth threatened in the Holy Scriptures because of its hypocrisies, idolatries, superstitions, infidelity, and enormous wickedness, 'because it hath transgressed the laws, changed the ordinance, and broken the everlasting covenant' (Isaiah xxiv.), with such a terrible judgment, as hath not been, nor ever shall again be seen upon the earth; in the which deluge of wrath she shall be *clean dissolved*, as the synagogue was heretofore in the destruction of Jerusalem, when she in like manner had filled up the measure of her iniquity:— which fearful consummation I judge to be close at hand, both by the signs of the times, and from the prophetic numbers expressly given to guide us in the anticipation of these great Gentile judgments, which are mentioned in Scripture wherever and whenever the coming of the Lord is mentioned.

2. 'When the Lord shall have finished the taking of witness against the Gentiles, and summed up the present dispensation of testimony in this great verdict of judgment, and while the execution is proceeding, he will begin to prepare another ark of testimony, or rather to make the whole earth an ark of testimony; and to that end will turn his Holy Spirit unto his ancient people the Jews, and bring unto them those days of refreshing spoken of by all the holy prophets since the world began: in the which work of conveying to them his Spirit, by the preaching of the word, he may, and it is likely will, use the election according to grace, who still are faithful amongst the Gentiles; though I believe it will chiefly be by the sending of Elias, who is promised before the dreadful and terrible day of the Lord, and by other mighty and *miraculous* signs. This outpouring of the Spirit is known in Scripture by 'the latter rain,' of which I deem the religious revivals of the last thirty years to be as the first droppings of the shower, and our religious works and societies to be a sickly uncertain hue of verdure, which the withered stump by the scent of the waters hath put forth, and like all God's gifts it will be given to those who will receive it, both Gentiles and Jews, and will prove the touchstone of both;—amongst the Gentile church awakening those persecutions of the last Antichrist which the faithful are taught to expect immediately before the coming of the Lord, and of which they have already had a foretaste in several of the Protestant churches abroad; in the Jewish church accomplishing that refining and passing through the fire which is spoken of immediately on their restoration. (Mal. iii. 3; Zech. xiii. 9). Which Antichristian spirit among the Gentiles, and enraged infidel spirit among the Jews, may amalgamate with one another, to produce a spurious restoration of the nations to their own land, and occasion that great warfare in the neighbourhood of Jerusalem, when Antichrist shall fall, and his powers be broken, in the battle of Armageddon. But the faithful among the Jews, now brought to believe on him whom

they have pierced, shall in the mean time be prepared by much sorrow, and distress, and supplication, for the coming of the Lord to settle and establish them surely and for ever in their own land; and the faithful among the Gentiles shall be expecting the Lord to deliver them, according to the promises which he hath made to his elect church of being raised from the dead, or changed among the living at his coming, and all gathered to him in that day. It was my second proposition, that in this way the Lord will be preparing for himself an ark of testimony in the Jewish nation, through whom to make the whole world one great and universal ark of faithful testimony.

3. 'That these judgments upon the Gentile nations, and all the earth, he will finish by his own personal appearance in flaming fire, taking vengeance on those who know not God and obey not the gospel of our Lord Jesus Christ; raising those who sleep in Jesus, and changing those of the Gentile church who still abide in life; and preserving the mourning Jewish church, as Goshen was preserved in the plagues of Egypt: and when the promised land shall have been cleared of all intruders, and they themselves by suffering perfected for the habitation of it, he shall lead them into it with a mighty and outstretched arm: and sit upon the throne of David, judging and seeking judgment, and hasting righteousness; and send forth the law from Zion, and the word of the Lord from Jerusalem; and rule among the nations, and be the prince of universal peace; using in this judgment and government of the earth his risen saints, who shall be his ministers to execute whatever his pleasure is. And thus, Satan being cast out, and the prince of light, and the heavenly Jerusalem, the dwelling place of his elect church being present, the Jerusalem on earth, with the house of Jacob, and all the nations, shall enjoy that fulness of peace and joy, that millennial reign of righteousness, for which we all hope and pray, and diligently labor.'

He afterwards thus meets what he considers as the two principal objections to his theory:—

'But here two questions present themselves. 1. If, as you have argued, the world be of such rebellious stuff, that in the face of this dispensation of witness and testimony, sustained all the while by an active Providence, it will not amend its obstinate ways, but persevere in them to the end; yea, and wax bolder and bolder against God and his chosen ones; until it is necessary to take measures that the cause of righteousness perish not utterly, by coming upon the confident world with a series of judgments, which shall make it reel to and fro like a drunkard, and consume its inhabitants, till hardly 'a gleaning as of the vintage grapes is left;' how all at once shall it come to pass that the most obstinate of the nations shall at once be converted, and the whole world follow in its train, and persevere in a state of peace and blessedness? This is precisely the question to which I desire the attention of the church. How, indeed, will that great revolution be effected? I have a means most effectual in the casting out of Satan with all his angels from the possession of the earth and the heavens, in the destruction of all his works of despotism and superstition, infidelity and radicalism from the face of the whole earth. He who was the beginner of the declension, and of all the mischief which the earth has endured, must be cast out by the seed of the woman, before the warfare will end which the seed of the woman in his church hath maintained till this hour against the serpent and his generation of vipers. This is the great work behind the scenes in the spiritual world, out of the observation of the sense of man, which will prepare the way for the great work of peace and blessedness, which will then follow, almost as of course, before the scenes, that is in the intercourse and conduct of men. I say almost of course, yet not altogether of course; because though Satan shall then be cast out of the world, and his active temptations wholly at an end, men will still be in the flesh and heirs of death, during the whole period of the millennial kingdom. And therefore they will need government, both civil and ecclesiastical, a law and a religion, or rather a law in a religion; that is, the same law of righteousness which we now possess, administered according to the wisdom of Christ and his reigning church, without any opposition or strife of Satan. Power shall then be holy; and the creation shall then be pure, and the bondage of Satan shall have ceased. There is not only this negative, but also another provision of a positive kind, which answers to the second question that might be started from the premises, viz. And what is to become of those spiritual witnesses, who since the calling of Abraham have been raised up in the likeness of Christ Jesus, to preserve the testimony of the righteousness which is by faith in his blood? What is to become of this elect church that have suffered, before his incarnation and since his incarnation, by the same eternal Spirit, and for the same end of the Father's glory for which he suffered? To this I answer that the whole Scripture, from the beginning to the ending of it, doth testify that they shall come with Christ to be partakers of his glory, that he may be glorified in them in whom also he was dishonored; and that they may be the sharers of that throne, and kingdom, and power, whereof he hath the promise from the Father, and is now expecting the fulfilment. These are the dead who shall hear the voice of the Son of God and live. These are they who shall be changed. These are they who shall meet the Lord in the air, and reign with him on the earth, and be for ever with the Lord, in that new Jerusalem which cometh down from heaven. This new Jerusalem is that which flesh and blood cannot inherit, where they neither marry nor are given in marriage, but are like the angels of God. And this is that of which the pillar of fire was the emblem in the wandering church; and the Shechinah, or glory between the cherubim, was the emblem in the resting church. There shall be to the whole earth such a glory, beyond the light of the sun, as there was in the holy of holies in the temple of Jerusalem; in which shall dwell the shining ones, the companions of the Lord, the true priesthood after the order of Melchisedek, who shall undertake the

government of the whole earth, and carry it on under the great king; by whose active ministry, by whose speedy obedience, passing to and fro at will with angelic freedom and readiness, they shall preserve and maintain that peace and blessedness amongst the sojourners of the earth, in which the millennium will consist. And thus, without going into further particulars, it is that the change in the world's temper and condition will be accomplished; and thus that the elect church will be rewarded by being made the spouse, the sister of the king, the joint-heirs, the fellow-judges, and governors, and possessors of the kingdom.

'Such, in few words, is the form of doctrine concerning the second advent of our blessed Lord, which was made known to me in the much study of the Holy Scriptures; and which, after several months of secret meditation, I began last Christmas, with all discretion and with fear and trembling, to break up and deal out to the church which God hath committed to my charge, resting and grounding the substance of it all upon the very words of our Lord himself, and using the Old Testament only when the language manifestly carried me thither, and the other books of the New Testament for further exposition and unfolding of those seeds of truth which are all contained in our Lord's own recorded discourses. For I hold it to be a great principle, which may almost be laid down as a canon of exposition, that every fundamental truth of faith should be shown to be present under some form or other, in every part, or rather I should say in every period, of divine revelation, unfolding itself more and more onwards to the end.'

We cannot afford space for a more enlarged view of this new scheme. The above are extracts from the Preliminary Discourse of this popular commentator, prefixed to his Translation of a Spanish work entitled La Venida del Mesias en Gloria y Majestad, 1827.

MILLE PASSUS, or MILLIA PASSUUM, a very common expression among the ancient Romans for a measure of distance, commonly called a mile. Milliarium was rarely used. Heyschius made it to consist of seven stadia; Plutarch little short of eight; but Strabo, Polybius, and many others, make it just eight stadia. This distance is sometimes called lapis. Each passus consisted of five feet.

MILLEP'EDES, *n. s.* Fr. *mille-pieds;* Lat. *mille* and *pes*, foot. A species of wood-lice, well furnished with feet, as well as teeth.

If pheasants and partridges are sick, give them *millepedes* and earwigs, which will cure them.

Mortimer's Husbandry.

MILLEPES, or wood-louse, in entomology, a species of oniscus. These insects are found in cellars, under stones, and in cold moist places; in the warmer countries they are rarely met with. Millepedes have a faint disagreeable smell, and a somewhat pungent, sweetish, nauseous taste.

MILLEPORA, in natural history, a genus of lithophytes, of a hard structure and full of holes, which are not stellate or radiated, and whose animal is the hydra. It differs from the madrepora, and comprehends fourteen different species. The animal, which forms and inhabits the millepora, occupies the substance; and the milleporæ grow upon one another; these little animals produce their spawn, which, attaching itself either to the extremity of the body already formed, or underneath it, gives a different form to this production. Hence the various shapes of the millepora, which is composed of an infinite number of the cells of those little insects, which all together exhibit different figures, though every particular cellula has its essential form, and the same dimensions, according to its own species.

MILLER (Joseph), a witty actor, whose name is identified with a low kind of wit where-ever the English language is known, was born in London in 1684, and was a favorite low comedian. He performed Sir Joseph Wittol, in Congreve's Old Bachelor; and Ben in Love for Love. Another of his characters was Teague, in The Committee. He died August 15th, 1738, and was buried in the church-yard of St. Clements, where a stone (recently renewed) was placed to his memory, with an epitaph, written by 'Stephen Duck.' The jests which have immortalised his name were collected by John Mottley, author of the Life of Peter the Great, and other works. They had run through eleven editions in 1751, and were reprinted, after a lapse of thirty years, by Barker, of Russel Street. A copy of the original edition was lately valued at ten guineas.

MILLER (James), an English dramatic writer, born in Dorsetshire, in 1703. He studied at Oxford, entered into orders, and published, 1. The Humors of Oxford, a comedy; acted in 1729: 2. Mahomet, a tragedy; which had a great run: 3. A volume of Sermons: 4. Poems, &c. He died in 1743.

MILLER (Philip), F.R.S., a celebrated botanist and gardener, born in Scotland, in 1691. He succeeded his father as gardener to the Apothecaries' Company at Chelsea, in 1722. He published several works, the principal of which is his Gardener's Dictionary, in folio. He died in 1771.

MILLER (Edward), music doctor, was of humble parentage and born at Norwich in 1736. Eloping from his father, he went to Lynn, where Dr. Burney first discovered his genius for music. He obtained in 1756 the appointment of organist at Doncaster, and after continuing in this situation thirty years took his doctor's degree at Cambridge. To his skill on the organ, he added that of an excellent flute player, and performed upon this instrument in Handel's oratorios. Dr. Miller was the author of The elements of Thorough Bass and Composition; The Institutes of Music; and of a topographical work of merit on the History and Antiquities of Doncaster. He also arranged and published a set of new melodies for the Psalms. His death took place at Cambridge in 1807.

MILLERIA, a genus of the polygamia necessaria order, and syngenesia class of plants; natural order, forty-ninth, compositæ.

MILLES (Jeremiah), F.R.S., a learned antiquary and divine, born in Hampshire, in 1713, and educated at Eton and Baliol Colleges, Oxford; of which his father, Jeremiah, was tutor and

fellow. He took his degree of A. M. in 1735, and of D.D. in 1747. His uncle, Thomas Milles, bishop of Waterford, gave him a prebend, and left him a large fortune in 1740. He married a daughter of archbishop Potter, through whom he obtained various preferments in England, the last of which was the deanery of Exeter, in 1762. In 1759 he was elected president of the Antiquarian Society. He published an elegant edition of Rowley's Poems, with a glossary; but was treated with great asperity by his opponents in that controversy. He also published a sermon, several papers in the Archeologia, and left many curious MSS. on Doomsday Book, on the Danish coinage, and ample materials for a history of Devonshire. He died at London, February 13th, 1784, aged seventy-one, leaving three sons and two daughters.

MILLESIMO, a town of France, in the department of the Stura, and late duchy of Montserrat, ten miles east of Ceva. On the 11th of April, 1796, the defiles leading to it were forced by the French under Buonaparte and Augereau, and the Austrians under general Provera, defeated with the loss of 1500 grenadiers; and on the 16th a second battle took place, in which the Austrians were again defeated, about 1000 men killed, and general Provera obliged to surrender with 9000 men, thirty-two pieces of cannon, and fifteen pairs of colors.

MIL'LET, *n. s.* Fr. *millet;* Ital. *milgio;* Lat. *milium.* A plant, see MILIUM. Also misprinted for MULLET, a fish, which see.

Some fish are gutted, split, and kept in pickle; as whiting, mackerel, *millet.* *Carew.*

In two ranks of cavities is placed a roundish stud, about the bigness of a grain of *millet.*
Woodward on Fossils.

Millet is diarrhœtick, cleansing, and useful in diseases of the kidneys. *Arbuthnot on Aliments.*

The *millet* hath a loose divided panicle, and each single flower hath a calyx, consisting of two leaves, which are instead of petals, to protect the stamina and pistillum of the flower which afterwards becomes an oval shining seed. This plant was originally brought from the eastern countries, where it is still greatly cultivated, from whence we are annually furnished with this grain, which is by many persons much esteemed for puddings. *Miller.*

MILLET, in botany. See MILIUM.

MILLET GRASS. See PANICUM.

MILLET, INDIAN. See HOLCUS.

MILLETIERE (Theophilus Brachet), lord of, a Protestant French advocate of the seventeenth century, who studied the law at Heidelberg; afterwards studied Hebrew, became a divine, and obtained an office in the consistory of the church of Paris. Being elected a representative of the assembly of Rochelle, he had a principal hand in their most spirited resolutions, and wrote a work encouraging the reformers to take up arms; upon which he was imprisoned and put to the torture. Yet, after all this, being liberated, he turned Roman Catholic, in 1645, and wrote several tracts for the purpose of reconciling the Huguenots to the mother-church, which only procured him the ill will of both parties. He died in 1665.

MILLIARIUM AUREUM was a gilded pillar in the forum of Rome, at which all the highways of Italy met, as one common centre. From this pillar the miles were counted, and at the end o every mile a stone was put down. The miliary column was erected by Augustus Cæsar, and is still to be seen.

MI'LLINER, *n. s.* I believe from Milaner, an inhabitant of Milan, as a Lombard is a banker.—Johnson. But there is a Goth. and Swed. *milla* and *molla,* to divide, and also to deal. One who sells ribands and dresses for women.

He was perfumed like a *milliner;*
And 'twixt his finger and his thumb he held
A pouncet box, which ever and anon
He gave his nose. *Shakspeare. Henry IV.*

The mercers and *milliners* complain of her want of publick spirit. *Tatler.*

If any one asks Flavia to do something in charity, she will toss him half a crown, or a crown, and tell him, if he knew what a long *milliner's* bill she had just received, he would think it a great deal for her to give. *Law.*

MILLION, *n. s.* } Fr. *million;* Ital. *milliogne.*
MILLIONTH, *adj.* } Ten hundred thousand; taken proverbially for any very large number.

Within thine eyes sat twenty thousand deaths,
In thy hands clutched as many *millions,*
In thy lying tongue both numbers. *Shakspeare.*

There are *millions* of truths that a man is not concerned to know. *Locke.*

She found the polished glass whose small convex
Enlarges to ten *millions* of degrees
The mite, invisible else. *Phillips.*

Midst thy own flock, great shepherd, be received;
And glad all heaven with *millions* thou hast saved.
Prior.

The first embrio of an ant is supposed to be as big as that of an elephant; which nevertheless can never arrive at the *millionth* part of the other's bulk. *Bentley.*

The *million* flit as gay
As if created only like the fly,
That spreads its motley wings in the eye of noon,
To sport their season, and be seen no more.
Cowper.

MILLO, a part of mount Zion at its extremity; and therefore called Millo of the city of David (2 Chron. xxxii.), taken in with the wall that encompassed mount Zion. It is uncertain whether Beth-Millo (Judges ix. 20) denotes a place; if it did, it lay near Shechem.

MILLOT (Claude Francis Xavier), a member of the French academy, born at Besançon, in March 1726, and for some time a Jesuit. He continued to preach after he left the Society: but the weakness of his voice and his timidity, not permitting him to continue in this profession, he relinquished it. The marquis of Felino, minister of Parma, having instituted an historical class for the benefit of the young nobility, he gave the charge of it to abbé Millot. After having filled the historical chair, with great approbation, he returned to France, and was appointed preceptor to the duke of Enghien. In this situation he died, A. D. 1785, aged fifty-nine. He composed several works, which are digested with great care, and written in a pure, simple, and natural style. The principal are, 1. Elemens de l'Histoire de France, depuis Clovis jusque à Louis XIV. 3 vols. 12mo, 2. Elemens de l'Histoire d'Angleterre, depuis son origine sous les

Romains, jusqu' à George II.; 3 vols. 12mo. 3. Elemens de l'Histoire Universelle, 9 vols. 12mo. 4. L'Histoire des Troubadours, 3 vols. 12mo, compiled from the MSS. of M. de Sainte-Palaie. 5. Memoires Politiques et Militaires, pour servir à l'Histoire de Louis XIV, et de Louis XV., composed from original papers collected by Adrian Maurice, duke of Noailles, marshal of France, in 6 vols. 12mo. 6. Several Discourses on Philosophical Questions; and 7. Translations of the most Select Harangues in the Latin Historians.

MILMAN (Sir Francis), M. D., baronet, was the son of a clergyman of Devonshire, where he was born in 1746. After receiving a grammatical education with a view to the church he entered of Exeter College, Oxford, where, in 1767, he took the degree of M. A., but directed his attention to physic: in 1770 he proceeded to the degree of bachelor in that faculty. In 1776 he completed his graduation as a doctor, and now entered into orders, actually taking his degree of B. D. in 1778. Returning to the practice of physic, he travelled on Dr. Radcliff's foundation, and attended the duke of Gloucester at Rome. This circumstance fixed his professional pursuits; on his return to England, he became a member of the Royal Society, and a fellow of the College of Physicians, by whom, in 1780, he was appointed to deliver the Gulstonian lecture. After this he was nominated physician to the king and the royal household; which procured his elevation to the baronetage. He died June 24th 1821. Sir Francis was the author of Animadversiones de Natura Hydropis ejusque curatione, 8vo. 1779; and A Treatise on the Source of the Scurvy and Putrid Fever, 8vo. 1782.

MILNE (Colin), LL. D., a divine and botanist, was born at Aberdeen, and educated at the Marischal College there, under his uncle, Dr. Campbell. Thence he removed to Edinburgh; after which, becoming tutor to lord Algernon Percy, he took orders in the church of England, and was presented to the rectory of North Chapel, Essex. He was also chosen lecturer of Deptford, and obtained the degree of doctor of laws from Aberdeen. He died in 1815. He published 1. A Botanical Dictionary, 8vo. 2. Linnæi Institutiones Botannicæ, 4to. 3. Indigenous Botany, or the Habitats of English Plants. 4. A volume of sermons, 8vo.

MILNER (Joseph), a modern divine, and ecclesiastical historian, was the son of a poor weaver at Leeds, and born there in 1744. He was educated at the free grammar-school, and at Catherine Hall, Cambridge, where he took his bachelor's degree in 1766, and obtained one of the chancellor's medals. Entering into orders he became master of the grammar-school, and afternoon lecturer, at Hull. He was afterwards presented to the vicarage of North Ferriby; and latterly to that of the Holy Trinity church in Hull. He died November 15th, 1797. His works are, 1. The Life of William Howard. 2. Answer to Gibbon's Attack on Christianity. 3. Essays on the Influence of the Holy Spirit. 4. A History of the Church of Christ, 4 vols. 8vo. 5. Two volumes of sermons, with his life prefixed.

MILNER (Isaac), D. D., younger brother of the preceding, was actually brought up to the weaving business; but, while at the loom, was so intent on study, and so devoted to the classics and mathematics, that his brother took him for an assistant in the grammar-school, and afterwards sent him to Queen's College, Cambridge, where, in 1774, he was senior wrangler, and gained the first mathematical prize. He soon became a tutor in that science; and, among other pupils, had Mr. Wilberforce and Mr. Pitt, with whom he made a tour on the continent. In 1783 he was appointed professor of natural philosophy; and in 1788 elected master of his college. The same year he was made dean of Carlisle; in 1792 he served the office of vice-chancellor; and in 1798 succeeded Waring as Lucasian professor of mathematics. He died in 1820. His publications are, 1. Animadversions on Hawker's Church History. 2. A Continuation of his brother's Ecclesiastical History. 3. Strictures on the Publications of Dr. Marsh, respecting the Bible Society. 4. Life of Mr. Joseph Milner, prefixed to his sermons.

MILO, the son of Diotimus, a celebrated athlete of Crotona in Italy. He early accustomed himself to carry the greatest burdens, and by degrees became a prodigy of strength. It is said that he carried on his shoulders a young bullock, four years old, for above forty yards; afterwards killed it with one blow of his fist, and ate it up in one day. He was seven times crowned at the Pythian games and six at the Olympian. He presented himself a seventh time; but no one had the courage or boldness to enter the lists against him. He was a disciple of Pythagoras; and to his uncommon strength, it is said, the learned preceptor and his pupils owed their lives. The pillar which supported the roof of the school suddenly gave way, but Milo supported the whole weight of the building, and gave the philosopher and his auditors time to escape. In his old age, Milo attempted to split a growing tree, and partly effected it; but his strength being gradually exhausted, the tree, when half cleft, reunited, and his hands remained pinched in the body of the tree. He was then alone; and, being unable to disentangle himself, he was devoured by wild beasts, about A. A. C. 500.

MILO (T. Annius), a native of Lanuvium, who attempted to obtain the consulship at Rome. Clodius the tribune opposed his views, yet Milo would have succeeded had not an unfortunate circumstance taken place between his suite and that of Clodius as he was going to the country. Clodius and eleven of his servants were killed, and the body of the murdered tribune was carried to Rome and exposed to public view. Cicero, as is well known to every classical student, undertook the defence of Milo, but with no effect; he was condemned and banished to Massalia.

MILO, an island in the Archipelago, anciently called Melos, about sixty miles in circumference, with a harbour, which is one of the largest in the Mediterranean. This island was formerly rich and populous. From the earliest times of antiquity it enjoyed liberty; but, the Melians having refused to join the Athenians in the Peloponnesian war, the latter made a descent upon the

island, and, although in two different expeditions they failed of their purpose, they accomplished it in the third, and killed or carried captive all the inhabitants. See MELOS. This act of cruelty disgraces the Athenian name. But Lysander, the Lacedemonian general, expelled the Athenian colony and re-established the remains of its original inhabitants. Melos afterwards lost its liberty when the Romans conquered all the isles of the Archipelago. In the partition of the empire, it fell to the eastern emperors, was governed by dukes, and was at last conquered by Soliman II. Since that period it has groaned under the yoke of Turkish despotism, and has lost its opulence and splendor. At the commencement of the eighteenth century it had seventeen churches, eleven chapels, and above 20,000 inhabitants. It was very fertile in corn, wine, and fruits; and the whole space from the town to the harbour, which is nearly two miles, was laid out in beautiful gardens. M. Tournefort, who visited it in 1700, gives the following fine description of it. 'The earth, being constantly warmed by subterraneous fires, produced almost without interruption plentiful crops of corn, barley, cotton, vines, and melons. St. Elias, the finest monastery in the island, and on the most elevated spot, is encircled with orange, citron, cedar, and fig trees. Its gardens are watered by a copious spring. Olive trees grow in great abundance around it. The vineyards afford excellent wine. In a word, all the productions of the island are the very best of their kinds; its partridges, quails, kids, and lambs, are highly valued, and yet may be bought at a very cheap price.' But M. Savary says, in his forty-second Letter on Greece, that 'were M. Tournefort to return to Milo, he would no longer see the fine island which he has described. He might still see alum, in the form of feathers, and fringed with silver thread, hanging from the arches of the caverns; pieces of pure sulphur filling the cliffs of the rocks; a variety of mineral springs; hot baths, though these are now only a set of small dirty caves; the same subterraneous fires which in his days warmed the bosom of the earth, and were the cause of its extraordinary fertility: but instead of 5000 Greeks, paying the capitation tax, he would now find no more than about 700 inhabitants on an island eighteen leagues in circumference. He would sigh to behold the finest lands lying uncultivated, and the most fertile valleys converted into morasses; of the gardens scarcely a vestige left; three-fourths of the town in ruins, and the inhabitants daily decreasing. During the last fifty years, Milo has assumed a quite different appearance. The plague, which the Turks propagate every where, has cut off one part of its inhabitants; the injudicious administration of the Porte, and the oppressive extortions of the pacha, have destroyed the rest. For want of hands, they cannot cut out a free channel for their waters, which stagnate in the valleys, corrupt, and infect the air with their putrid exhalations. The salt marshes, being equally neglected, produce the same effects. Sulphureous exhalations arise all over the island, by which the inhabitants of Milo are afflicted with dangerous fevers during three-fourths of the year. Yet a judicious and enlightened government might expel those evils. The whole inhabitants of this island are now below 1000, of whom not the fifth part inhabit the petty village which is the chief place. Long. of the harbour of Milo, 24° 13′ 32″ E., lat. 36° 42′ 30″ N.

MILT, *n. s.* & *v. a.* } Saxon milt; Belgic
MIL'TER, } *mildt*; Teut. *miltz*; Ital. *millte*. The spleen; the sperm of a male fish: to milt is to impregnate the roe or spawn of the female fish: milter is a name for the male.

You shall scarce take a carp without a *melt*, or a female without a roe or spawn. *Walton's Angler.*

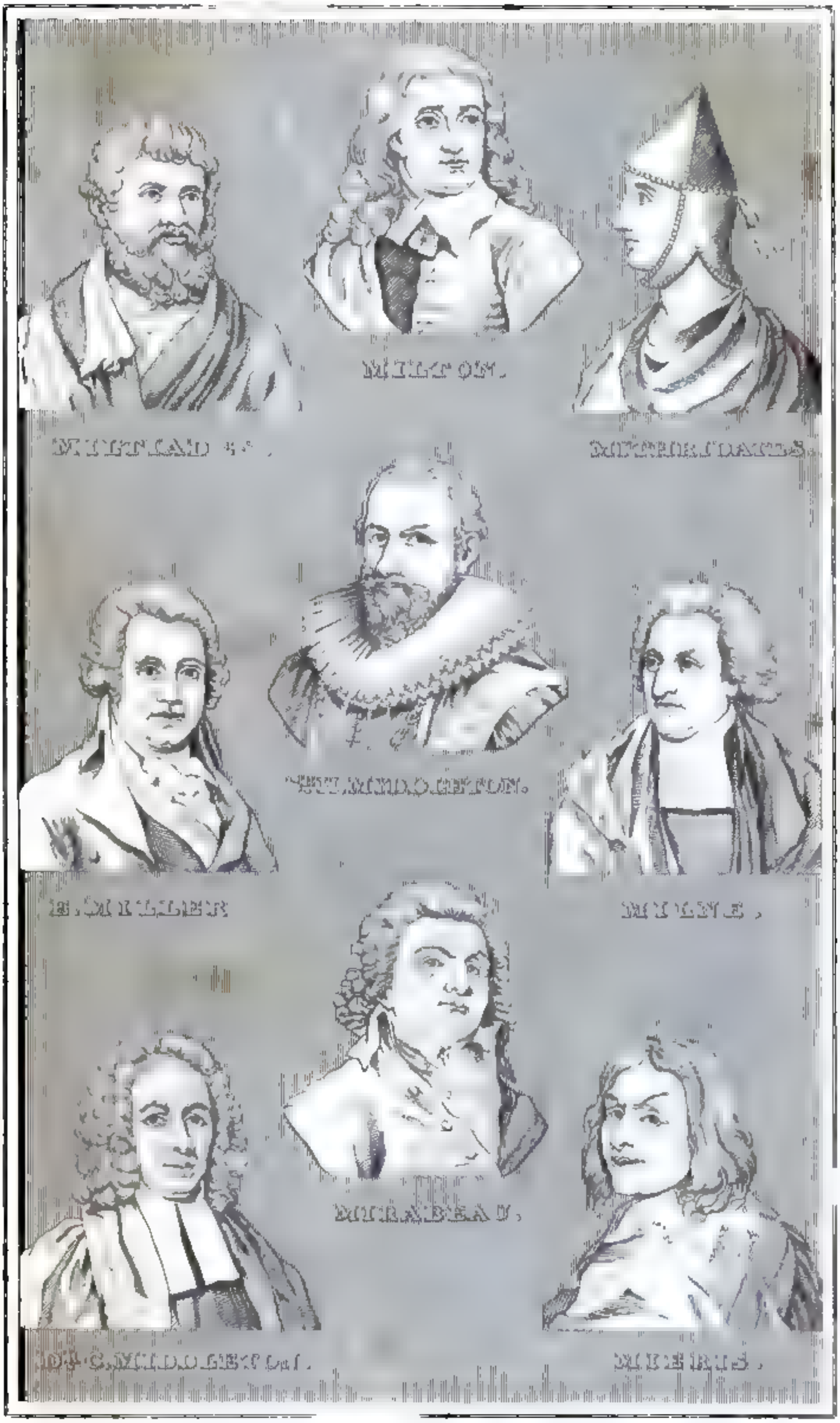
The spawner and *milter* labor to cover their spawn with sand. *Id.*

MILT, or MELT, in natural history, the soft roe in fishes, thus called from its yielding, by expression, a whitish juice resembling milk.

MILTHORP, a town of Westmoreland, at the mouth of the Can, five miles from Kendal. It is the only sea-port in the county, and goods are brought hither in small vessels from Grange in Lancashire. Here are two paper-mills. It has a market on Friday, with a fair on old May-day; and a good stone bridge over the river Betha, which runs through the town.

MILTIADES, an Athenian general, son of Cypselus. He obtained a victory in a chariot-race at the Olympic games. He led a colony of Athenians to the Chersonesus. The causes of this appointment are striking and singular. The Thracian Dolonci, harassed by a long war with the Absynthians, were directed by the oracle of Delphi to take for their king the first man they should meet in their return home, who should invite them to come under his roof, and partake his entertainments. They met Miltiades, whom their appearance, with their strange arms and garments, struck. He invited them to his house, and was made acquainted with the commands of the oracle. He obeyed; and, when the oracle of Delphi had approved a second time the choice of the Dolonci, he departed for the Chersonesus, and was invested by the inhabitants with sovereign power. The first measure he took was to stop the further incursions of the Absynthians by building a strong wall across the Isthmus. When he had established himself, and fortified his dominions, he turned his arms against Lampsacus. He was afterwards taken in an ambuscade, but Crœsus, king of Lydia, procured his release. He lived a few years after he had recovered his liberty. As he had no issue he left his kingdom and possessions to Stesagoras, the son of Cimon, who was his brother by the same mother. The memory of Miltiades was greatly honored by the Dolonci; and they regularly celebrated festivals in commemoration of a man to whom they owed their preservation and greatness.

MILTIADES, the son of Cimon, and brother of Stesagoras above mentioned, was, some time after the death of the latter, who died without issue, sent by the Athenians, with one ship, to take possession of the Chersonesus. At his arrival Miltiades appeared mournful, as if lamenting the recent death of his brother. The principal inhabitants of the country visited the new governor to condole with him; but Miltiades abused their con-


MILTON.
MILTIAD
MITHRIDATES.
MIDDLETON.
E. MILLER
MYLNE.
MIRABEAU.
D^R C. MIDDLETON.
MIERIS.

fidence, seized their persons, and made himself absolute in Chersonesus. To strengthen himself he married Hegesipyla, the daughter of Olorus, king of the Thracians. When Darius I., king of Persia, undertook an expedition against the Scythians, and throwing a bridge across the Danube marched into their country, he entrusted the guard of the bridge to the Ionian Greeks, the commanders of whom he had attached to himself by raising them to the supreme authority in their several cities. Miltiades, who was one of them, excited by that spirit of Grecian patriotism to which every other duty was made subservient, urged the other leaders to break down the bridge, in order that a prince so entirely inimical to Grecian liberty might never return in safety. His council was approved by all the rest except Hystiæus the Milesian, who had influence enough to prevent its taking effect. Miltiades, judging it imprudent to await the monarch's return, embarked for Athens, and in his way took possession of the isle of Lemnos for his countrymen. At the celebrated battle of Marathon all the chief officers ceded their power to him; and, by his superior abilities, an important victory was gained over the more numerous forces of the Persians. Some time after Miltiades was entrusted with a fleet of seventy ships, and ordered to punish those islands which had revolted to the Persians. He was successful at first; but, on a sudden report that the Persian fleet was coming to attack him, as he was besieging Paros, he raised the siege, and returned to Athens. He was accused of treason, and Miltiades, not being able to come into the assembly on account of a wound which he had received before Paros, his enemies, taking advantage of his absence, became more eager in their accusations. He was condemned to death, but the rigor of his sentence was retracted on account of his great services to the republic; and he was put in prison till he should pay a fine of fifty talents to the state. His inability to discharge so great a sum detained him in confinement; and, his wounds becoming incurable, he died a prisoner about A. A. C. 489. His body was ransomed by his son Cimon, who was obliged to borrow fifty talents to give his father a decent burial. The accusations against him were the more readily believed, because he had made himself absolute in Chersonesus. Cornelius Nepos has written the life of Miltiades; but he confounds the actions of the son of Cimon with those of the son of Cypselus.

MILTON (John), the most illustrious of the English poets, was descended of a genteel family seated at Milton in Oxfordshire. He was born December 9th, 1608, and received his education first under a private tutor, afterwards at London, in which his father had settled as a scrivener. At the age of seventeen he was sent to Christ's College, Cambridge, where he made a great progress in all parts of academical learning. In 1628 he proceeded A. B., having performed his exercise for it with great applause. His father designed him for the church; but young Milton's attachment to the muses was so strong that it became impossible to engage him in any other pursuit. In 1632 he took the degree of A. M., and retired to the residence of his parents at Horton, near Colnbrook, in Bucks, where he enriched his mind with the choicest stores of Grecian and Roman literature; and wrote his poems of Comus, L'Allegro, Il Penseroso, and Lycidas. About five years afterwards he travelled into France and Italy, and at Paris became acquainted with the celebrated Grotius. Upon his return he set up an academy in Aldersgate-Street, London. In 1641 he began to write in defence of the Presbyterian party; and in 1642 he married the daughter of Richard Powel esq. of Forest Hill, in Oxfordshire; who being a zealous royalist she was soon advised to return to her relations; which so incensed her husband that he resolved never to take her again, and wrote and published several tracts in defence of the Doctrine and Discipline of Divorce. He also paid his addresses to another lady; but this incident proved the means of a reconciliation with Mrs. Milton, who purposely threw herself in his way at the house of a mutual relation, and on her knees entreated and received his forgiveness. This affecting incident made a deep impression on Milton's sensibility, and enabled him to paint to the life the beautiful scene in his Paradise Lost, b. x. v. 940; where, describing Adam's feelings, he says,

> Soon his heart relented
> Towards her, his life so late and sole delight,
> Now at his feet submissive in distress.

In 1644 he wrote his Tract upon Education and the restraint on the liberty of the press being continued by act of parliament, he wrote boldly and nobly against that restraint. In 1645 he published his juvenile poems; and about two years after, on the death of his father, he took a smaller house in High Holborn, the back of which opened into Lincoln's Inn Fields. Here he quietly prosecuted his studies till the death of Charles I., on which occasion he published his Tenure of Kings and Magistrates in justification of the fact. He was now taken into the service of the commonwealth, and made Latin secretary to the council of state, who resolved neither to write to foreign princes, nor to receive any answers, except in the Latin tongue, which was common to them all. The famous Εικων Βασιλικη coming out about the same time, Milton wrote and published his Iconoclastes the same year. It was also, by order of his masters, backed by the reward of £1000, that, in 1651, he published his celebrated piece entitled Pro Populo Anglicano Defensio, A Defence of the People of England, in answer to Salmasius's Defence of the King; which work spread his fame over all Europe. He now dwelt in a pleasant house, with a garden, in Petty France, Westminster. In 1652 he buried his wife, who died not long after the delivery of her fourth child; and about the same time lost his eye-sight by a gutta serena, which had been growing upon him many years. In 1653 Cromwell took the reins of government into his own hands, but retained Milton in his office. His leisure hours he employed in prosecuting his studies; wherein he was so far from being discouraged by the loss of his sight that he even conceived hopes this misfortune would add new

vigor to his genius, which, in fact, seems to have been the case. Thus animated, he again ventured upon matrimony; and married the daughter of captain Woodcock of Hackney, who died in childbed about a year after. On the deposition of the protector, Richard Cromwell, and on the return of the long parliament, Milton being still continued secretary, he appeared again in print, pleading for a further reformation of the laws relating to religion; and, during the anarchy that ensued, he drew up several schemes for re-establishing the commonwealth, exerting all his abilities to prevent the return of Charles II. England's destiny, however, and Charles's good fortune, prevailing, Milton retired to a friend's house in Bartholomew Close. A prosecution was intended against him; but the just esteem to which his admirable genius and extraordinary accomplishments entitled him, had raised him so many friends, even among those of the opposite party, that he was included in the general amnesty. This storm over, he married his third wife, Elizabeth, daughter of Mr. Minshull, a Cheshire gentleman; and, not long after, he took a house in the Artillery Walk. This was his last stage, where he resided longer than he had done any where. He now applied himself to finish his grand work, Paradise Lost; one of the noblest poems that ever were produced by human genius. It was published in 1667, and his Paradise Regained in 1670. After this he published many pieces in prose; for which we refer our readers to Millar's edition of his whole works in 2 vols. 4to. 1753. This great man died at his house in Bunhill Fields, November 10th, 1674, in his sixty-sixth year. A monument was erected to his memory in 1737, in Westminster Abbey, by Mr. Benson. His person was remarkably handsome, but his constitution was tender, and by no means equal to his incessant studies. Though he had lost great part of his fortune at the Restoration, yet he died worth £1500 in money, beside household goods. He left behind him three daughters, whom he had by his first wife; the youngest of whom was married and had ten children. Mr. Walpole pays as high a compliment to Milton's taste and genius in gardening as the public in general have allowed to his merits in poetry. His remains were interred in the church of Cripplegate, where the elder Samuel Whitbread has erected a monument to his memory. In 1750 the masque of Comus was performed for the benefit of one of his grand-daughters, named Foster, then in a very humble situation.

In 1825 was published his Treatise on Christian Doctrine in Latin and English, 4to. found among the state papers by Mr. Lemon. With it were found corrected copies of Milton's foreign despatches, and several papers relating to the popish trials and rye-house plots. The whole was wrapped in an envelope, addressed 'To Mr. Skinner, Merchant,' the well known friend of the poet. The authenticity of the MS. appears indeed unquestionable: it attests the Arianism of its great author; defends the sentiments he is well known to have adopted on the subject of divorce; advocates polygamy, anthropomorphitism (which Mr. Locke has somewhere said to be almost confined to the ignorant), the eternity of matter, and the abrogation of the Sabbath. His Latin style is always easy, often beautiful; the translation undertaken by order of his majesty (Geo. IV.) was made by Mr. Sumner, a royal chaplain. On the whole the work has disappointed the admirers of Milton. It has few claims to originality of thought or expression; was looked for with avidity, but will ever be read, we are persuaded, with difficulty by those who are at all acquainted with the subjects on which he writes, and presents to our view the melancholy exhibition of a great prostrate intellect struggling in the fetters of various and contradictory systems of theology—to make a worse.

MILTON, a post town of Saratoga county, New York, thirty miles north of Albany. Population 2763. It contains valuable mills, a woollen manufactory, and five houses for public worship.

MILTON, a market town of Kent, near Sittingbourn and the isle of Sheppey, six miles northwest of Feversham, and forty east of London; also called Middleton from its situation near the middle of the county, between Deptford and the Downs. The kings of Kent had a castellated palace here, which stood below the church, but was burnt down in Edward the Confessor's time by earl Godwin. The church stands a mile off. On approaching the town up the Thames, by east Swale, it seems hid among the creeks; yet it is large, and has a considerable market on Saturday, and a fair 24th July. The oysters taken hereabouts are the most famous in Kent. It is governed by a portreeve, and lies fourteen miles north-east of Maidstone.

MILTON, a town of Kent, a mile on the east side of Gravesend, incorporated with it in the reign of queen Elizabeth under a portreeve, jurats, &c. King Henry VIII. raised a platform here for the defence of both towns and the river. It has a fair 25th January.

MILVIUS, MOLVIUS, or MULVIUS, PONS, a bridge on the Tiber, two miles from Rome, on the Via Flaminia, built by Æmilius Scaurus the censor, in the time of Sylla, and repaired by Augustus. From this bridge the ambassadors of the Allobroges were brought back to Rome by Cicero's order, and made a discovery of Catiline's conspiracy.—Sallust. Near it Maxentius was defeated by Constantine.—Eutropius.

MILVUS, in ornithology, a species of falco.

MI'ME, *n. s.* & *v. n.*
MI'MER, *n. s.*
MIME'TIC, *adj.*
MIM'IC, *n. s. adj.* & *v. a.*
MIM'ICAL, *adj.*
MIM'ICALLY, *adv.*
MIM'ICRY, *n. s.*
MIMOG'RAPHER.

Fr. *mime;* Ital. *mimo;* Lat. *mimus, mimicus;* Gr. *μιμος.* Mime, mimer, and mimic, alike mean a jester, antic imitator, or buffoon: to mime or mimic is to imitate as a buffoon; ridicule by burlesque imitation: mimic, as an adjective, signifies imitative, resembling: mimetic, having the faculty of mimicing: mimicry, burlesque or ridiculous imitation: a mimographer is a word which we find only in Johnson for a writer of farces.

Think'st thou, *mime,* this is great? or that they strive,
Whose noise shall keep thy *miming* most alive,
Whilst thou dost raise some player from the grave,
Out-dance the babion, or out-boast the brave?

Ben Jonson.

Man is of all creatures the most *mimical* in gestures, styles, speech, fashion, or accents.
Wotton on Education.

Let us grant these faculties so fixed upon any nation, that all our water must necessarily be fetched at their well, and add unto these a few waste compliments and *mimical* courtesies, which must needs be put into the match of our ordinary travel.
Bp. Hall.

Jugglers and dancers, anticks, mummers, *mimers*.
Milton.

In reason's absence *mimick* fancy wakes
To imitate her; but misjoining shapes,
Wild work produces oft, and most in dreams.
Id.

Is not this plainly the life of a child, that is ever busy, yet never hath any thing to do? or the life of that *mimical* brute which is always active in playing uncouth and unlucky tricks. *Barrow.*

Singers and dancers entertained the people with light songs and *mimical* gestures, that they might not go away melancholy from serious pieces of the theatre. *Dryden's Juvenal.*

Morpheus expressed
The shape of man and imitated best;
The walk, the words, the gesture, could supply,
The habit *mimick*, and the mien belye. *Id.*

A *mimical* daw would needs try the same experiment; but his claws were shackled.
L'Estrange.

By an excellent faculty in *mimickry*, my correspondent tells me, he can assume my air, and give my taciturnity a slyness which diverts more than any thing I could say. *Spectator.*

Like poor Andrew I advance,
False *mimick* of my master's dance:
Around the cord awhile I sprawl,
And thence, though slow, in earnest fall. *Prior.*

Who would with care some happy fiction frame,
So *mimicks* truth, it looks the very same. *Granville.*

The busy head with *mimick* art runs o'er
The scenes and actions of the day before. *Swift.*

I called moreover into action my *mimetic* powers, and, before the expiration of my eleventh year, was able to imitate, with no small share of success, the tone and manner of the writing usher in pronouncing 'Very well, master Simkins, I shall sartinly get you vipt for dartying on your breeches.' *Canning.*

MIMI, MIMES, from μιμεομαι, to imitate; in the ancient comedy, buffoons or mimics, who entertained the people by imitating and caricaturing certain characters. There were, on the Roman stage, female performers of this kind called Mimæ. Some of the mimi acted their parts to the sound of the tibia; these they called mimauli.

MIMI were also a kind of farces or ludicrous comedies generally performed by one person. They had no acts, nor any exordium. They were introduced upon the Roman stage long after comedy and tragedy had arrived at perfection. The actor wore no mask, but smeared his face with soot, was dressed in lambskin, wore garlands of ivy, and carried a basket of flowers and herbs in honor of Bacchus, and diverted the audience with ridiculous tricks and dances. They afterwards underwent many alterations. See PANTOMIME.

MIMNERMUS, an ancient poet and musician of Smyrna, who flourished about A. A. C. 590, and was contemporary with Solon. Athenæus says he invented pentameter verse. His elegies, of which only a few fragments are preserved, were so much admired, that Horace preferred them to those of Callimachus. He composed one, as we learn from Pausanias, upon the battle between the people of Smyrna and the Lydians, under Gyges: and another in elegiac verse, quoted by Strabo, entitled Nanno. With respect to amorous poetry, Horace celebrates his abilities Ep. vi. lib. i. v. 65; and Propertius (lib. i. el. 9, v. 11) says,

Plus in amore valet Mimnermi versus Homero.

MIMOSA, the sensitive plant, a genus of the polygamia order, and monœcia class of plants, natural order thirty-third, lomentaceæ: HERMAPHRODITE. CAL. quinquedentate: COR. quinquefid; stamina five or more; pistil one, and a legumen: MALE CAL. quinquedentate: COR. quinquefid, with five, ten, or more stamina. The name mimosa signifies mimic, and is given to this genus on account of the sensibility of the leaves, which seem to mimic the motion of animals. To this genus Linnæus joins many of the acacias, and it comprises many different species, all natives of warm climates. Of the sorts cultivated in our stoves, &c., some are of the shrub and tree kind, and two or three are herbaceous perennials and annuals. The sensitive plants are exceedingly curious in the very singular circumstance of their leaves receding rapidly from the touch, and running up close together; and in some sorts the foot-stalks are affected, so as instantly to fall downward as if fastened by hinges; which last are called humble sensitives. They have all winged leaves, each wing consisting of many small pinnæ. In the Systema Vegetabilium this genus, including the mimosas properly so called, and the acacias, is divided into several sections, distinguished by the figure, situation, and arrangement of the leaves; as simple, simply pinnated, bigeminous and tergeminous, conjugate and pinnated, doubly pinnated. The following are the most remarkable species:—

1. M. arborea, the wild tamarind tree, is common in all the woodlands in Jamaica. It rises to a considerable height, and is proportionably thick. The timber is excellent, and serves many purposes in rural economy; it is of the color of cedar, pretty hard, and takes a good polish. The leaves are numerous; the flowers globular and white. The pods are about a foot long, of a fine scarlet color; when ripe they open and become twisted. The seeds then appear: they are oblong, smooth, and of a shining black and quite soft. The leaves, flowers, and pods exhibit a singular and beautiful contrast. It is raised in hot-houses in this country, but might be made to grow in the open air.

2. M. asperata, the Panama sensitive plant. Of this curious species, which has been well described by Dr. Browne, there is a good figure in the Reliquiæ Houstonianæ, published by Sir Joseph Banks. It grows in moist places, and by the sides of rivulets, in Jamaica. It seldom rises above three feet, but its slender branches extend considerably on the neighbouring bushes. It is armed with crooked sharp spines so thickly set on the trunk, branches, and leaves,

that there is no touching it with safety. 'But it is very beautiful: the flowers are yellow and globular, growing at the extremity of the branches. The pods are hairy, brown, and jointed, each containing a small, flat, and brown seed. The leaves are numerous, small, and winged, and very irritable, contracting with the least touch, and remaining so for several minutes after. This species would form a good hedge round a garden, and, by being trimmed now and then, may be easily kept from spreading.

3. M. catechu grows only to about the height of twelve feet, and one foot in diameter; it is covered with a thick rough brown bark, and, towards the top, divides into many close branches; the leaves are bipinnated, or doubly winged, and are placed alternately upon the younger branches. The partial pinnæ are nearly two inches long, and are commonly from fifteen to thirty pair, having small glands inserted between the pinnæ; each wing is usually furnished with forty pairs of pinnulæ or linear lobes, beset with short hairs; the spines are short, recurved, and placed in pairs at the bases of each leaf; the flowers are hermaphrodite and male, and stand in close spikes, which arise from the axillæ of the leaves, and are four or five inches long: the calyx is tubular, hairy, and divides at the limb into five oval pointed segments; the corolla is monopetalous, whitish, and of the same form as the calyx, but twice its length; the filaments are numerous, capillary, double the length of the corolla, adhering at the base of the germen, and crowned with roundish antheræ; the germen is oval, and supports a slender style, which is of the length of the filaments, and terminated by a simple stigma; the fruit or pod is lance-shaped, brown, smooth, compressed, with an undulated thin margin; it contains six or eight roundish flattened seeds, which produce a nauseous odor when chewed. From this tree, which grows plentifully on the mountains of Hindostan, where it flowers in June, is produced the officinal drug long known in Europe by the name of terra japonica.

4. M. cinerea, and M. pinnata, cashew bushes. These species are common about Kingston and Spanish town, Jamaica, and rise by slender trunks to about twenty feet. Dr. Roxburgh, of Madras, found the lac insect on these species.

5. M. cornigera, the horned Mexican mimosa, or great horned acacia, has a shrubby upright deformed stem, branching irregularly, armed with very large, horn-like, white spines, by pairs, connated at the base; bipinnated leaves thinly placed; and flowers growing in spikes. This species is esteemed for the oddity of its large spines, resembling the horns of animals, and which are often variously wreathed, twisted, and contorted.

6. M. cornuta, the horned ergett, a native of Abyssinia, described by Mr. Bruce. The flower very much resembles that of the acacia vera in size and shape, excepting that it is attached to the branch by a strong woody stalk of considerable length, which grows out at the bottom of the branch bearing the leaves, and is sheltered as in a case by the lower part of it. The branches are all covered with short, strong, and sharp-pointed thorns, having their points inclined backwards towards the root. The pods are covered with a prickly kind of hair, which easily rubs off with the fingers, sticks to them, and gives a very uneasy sensation. They have thirteen divisions, in each of which are three hard, round, and shining seeds, of a dusky brown color.

7. M. farnesiana, the fragrant acacia, grows in woodlands and waste lands in Jamaica; rising twenty-five or thirty feet, with suitable thickness. The bark of the trunk is brown and scaly, the branches are alternate. It is adorned with bipinnated leaves of a bright green color, and yellow globular flowers from the axillæ, of a fragrant smell. The pods are about three inches long, and half an inch broad: they are of a light brown color, smooth, compressed, and contain five or six smooth flat seeds. Formerly the flowers of this tree were used as an ingredient in the theriaca andromachi of the old dispensatories. It is sometimes planted for a hedge round enclosures; and the timber, though small, is useful in rural economy.

8. M. latifolia, shag-bark, or white wild tamarind. This excellent timber tree is very common in Jamaica, and rises to a moderate height and good thickness. The trunk is rough and scaly: the leaves are numerous, of a rhomboidal figure, and yellowish cast. The flower-spikes are from the axillæ; their color is yellow. The seed vessels are flat, jointed, and twisted. The seeds are of the bigness of a vetch, white, and finely streaked with blue.

9. M. nilotica, the true Egyptian acacia, rises to a greater height than the preceding: the bark of the trunk is smooth, and of a gray color; that of the branches has commonly a purplish tinge: the leaves are bipinnated, and placed alternately: the partial pinnæ are opposite, furnished with a small gland between the outermost pair, and beset with numerous pairs of narrow elliptical pinnulæ; the spines are long, white, spreading, and proceed from each side of the base of the leaves: the flowers are hermaphrodite and male; of a globular shape, and standing four or five together, upon slender peduncles, which arise from the axillæ; the calyx is small, bell-shaped, and divided at the mouth into five minute teeth; the corolla consists of five narrow yellowish segments: the filaments are numerous, capillary, and furnished with roundish yellow antheræ. the germen is conical, and supports a slender style, crowned with a simple stigma: the fruit is a long pod, resembling that of the lupin, and contains many flattish brown seeds. It is a native of Arabia and Egypt, and flowers in July. Though this species grows in great abundance over the vast extent of Africa, yet gum arabic is produced chiefly by those trees which are situated near the equatorial regions; and in Lower Egypt the solar heat is never sufficiently intense for this purpose. The gum exudes in a liquid state from the bark of the trunk and branches of the tree, like the gum often produced upon the cherry trees, &c., in this country: and by exposure to the air it soon acquires solidity. In Senegal it begins to flow when the tree first opens its flowers, and continues during the rainy season till December, when it is collected for the first

time. Another collection of it is made in March, from incisions in the bark. Gum arabic is now usually imported from Barbary in large casks. The various figures which it assumes depend upon accidental circumstances during its transudation and concretion. The pale yellowish gum is most esteemed; pieces which are large, rough, of a roundish figure, and of a brownish or reddish hue, are less pure, being produced from a different species; but the Arabian and Egyptian gum is commonly intermixed with pieces of this kind. Gum arabic does not admit of solution by spirit or oil; but in twice its quantity of water it dissolves into a mucilaginous fluid, of the consistence of a thick syrup; and in this state answers many useful pharmaceutical purposes, by rendering oily, resinous, and pinguious substances, miscible with water. It is preferred to most other gums as a demulcent in catarrhal affections, &c., and has been generally employed in cases of ardor urinæ and strangury. See CHEMISTRY and MEDICINE.

10. M. Pernambucana, the Pernambuca slothful mimosa, with unshrubby, procumbent, unarmed stems, branching two or three feet around; bipinnated leaves of three or four pairs of short winged foliola; and, at the axillæ drooping spikes of pentandrous flowers, the lower ones castrated. This species recedes very slowly from the touch, only contracting its pinnæ a little when smartly touched; hence the name slothful.

11. M. plena, the annual, or double-flowered sensitive mimosa, rises with an herbaceous, erect, round, unarmed stem, closely branching and spreading every way, three or four feet high; bipinnated leaves of four or five pairs of winged lobes, of many pairs of pinnæ; and at the axillas and termination of the branches, spikes of yellow pentandrous flowers, the lower ones double; succeeded by short broad pods. It is only sensitive in the foliola, but extremely sensible of the touch or air.

12. M. pudica, the bashful humble plant, rises with an undershrubby, declinated, prickly stem, branching two or three feet around, armed with hairy spines; pinnated, digitated leaves, each leaf being of five or more long folioles, attached by their base to a long foot-stalk, and spread out above like the fingers of a hand; and at the sides and ends of the branches roundish heads of greenish white flowers, succeeded by small jointed prickly pods. This is truly of the humble sensitive kind: for by the least touch the leaves instantly recede, contract, close, and with the foot-stalk quickly decline downward.

13. M. punctata, the punctuated sensitive mimosa, rises with a shrubby, upright, taper, spotted, unarmed stem, branching erectly five or six feet high; bipinnated leaves, of four or five pairs of long-winged folioles, having each about twenty pairs of pinnæ; and at the axillas and termination of the branches oblong spikes of yellowish decandrous flowers, the inferior ones castrated; succeeded above by oblong seed-pods. This sort, though naturally shrubby and perennial in its native soil, yet in this country sometimes decays in winter. It is only sensitive in the foliola, but quick in the motion.

14. M. quadrivalvis, the perennial, or quadrivalve humble mimosa, has herbaceous, slender, quadrangular, prickly stems, branching and spreading all around, armed with recurved spines; bipinnated leaves of two or three pairs of winged lobes, having each many pinnæ; and at the axillas globular heads of purple flowers succeeded by quadrivalvular pods. Both leaves and foot-stalks recede from the touch.

15. M. scandens, cacoons, mafootoo wyth, or the climbing mimosa. This species is frequent in all the upland valleys and woodlands on the north side of Jamaica. It climbs up the tallest trees, and spreads itself in every direction by its cirrhi or claspers, so as to form a complete arbor, and to cover an English acre from one root. This has a bad effect on the trees or bushes so shaded. Light, air, and rain, being shut out, the leaves drop off, the tree gradually rots, and the limbs fall down by the weight o, this parasite. The roots run superficially under the ground or herbage. The trunk is seldom thicker than a man's thigh, and sends off many branches, with numerous shining green leaves, each of which terminates in a tendril or clasper, that serves to fasten it to trees or bushes. The flower-spikes are from the axillæ; they are slender, and the florets small and numerous. The pod is perhaps the largest and longest of any in the world; being sometimes eight or nine feet long, five inches broad, jointed, and containing ten or fifteen seeds, which are brown, shining, flattened, and very hard, and called cacoons. They are mentioned in the Philosophical Transactions as being thrown ashore on the Hebrides and Orkneys. This happens in the following manner: the seeds or beans fall into the rivers, and are conveyed to the sea. The trade winds carry them westward till they fall into the gulf stream, which drives them northwards along the coast of America, and Bahama Islands. As the winds blow frequent and strong from America, these seeds are driven eastward, till they are thrown ashore and left with the tide as aforesaid. This bean, after being long soaked in water, is boiled and eaten by some negroes; but the chief use made of it is for a sort of snuff-box.

16. M. Senegalensis, the Senegal mimosa, is a native of Guinea, and was some time ago introduced into Jamaica. Dr. Wright saw both this and the nilotica, of the size of a cherry-tree, growing at Dr. Paterson's in the parish of Hanover, Jamaica. The flowers are globular, yellow, and fragrant. The pods are brown, and of the size of a goose-quill. The tree, on being wounded, exudes gum-arabic, though in a smaller quantity, and less transparent, than that of the shops, which is obtained from the nilotica.

17. M. sensitiva, the common humble sensitive plant, rises with an undershrubby prickly stem, branching six or eight feet high, armed with crooked spines; conjugated, pinnated leaves, with bijugated partial lobes or wings, having the inner ones least, each leaf on a long foot-stalk; and at the sides and ends of the branches many purple flowers in roundish heads, succeeded by broad, flat, jointed pods, in radiated clusters. The leaves and foot-stalks recede from the touch, though not with such facility as in some other species.

18. M. viva, the lively mimosa, or smallest sensitive weed, has many creeping-roots, and spreads itself so as to cover large spots of ground. It rises at most to two inches, has winged leaves, with numerous small pinnæ. The flower is globular, of a bluish color, and grows in clusters from the axillæ; these are followed by little short hairy pods, containing smooth, shining seeds. This is the most sensible of all the mimosas, the pudica not excepted. By running a stick over the plant, a person may write his name, and it will remain visible for ten minutes.

The sensitive plants are well known to possess a kind of motion, by which the leaves and stalks are contracted and fall down upon being slightly touched, or shaken with some degree of violence. The contraction of the leaves and branches of the sensitive plant when touched, is a very singular phenomenon. Different hypotheses have been formed by botanists to explain it; but these have generally been deduced rather from analogical reasonings than from a collection of facts and observations. The following are the most important facts collected upon this curious subject:—It is difficult to touch the leaf of a healthy sensitive plant so delicately that it will not immediately collapse, the foliola or little leaves moving at their base till they come into contact, and then applying themselves close together. If the leaf be touched with a little more force, the opposite leaf will exhibit the same appearance. If a little more force be applied, the partial foot-stalks bend down towards the common foot-stalk, from which they issue, making with it a more acute angle than before. If the touch be more violent still, all the leaves situated on the same side with the one that has been touched will instantly collapse, and the partial foot-stalk will approach the common foot-stalk to which it is attached, in the same manner as the partial foot-stalk of the leaf approaches the stem or branch from which it issues; so that the whole plant, from having its branches extended, will immediately appear like a weeping willow. These motions on the plant are performed by means of three distinct and sensible articulations. The first that of the foliola or lobes to the partial foot-stalk; the second that of the partial foot-stalk to the common one; the third that of the common foot-stalk to the trunk. The primary motion of all is the closing of the leaf upon the partial foot-stalk, which is performed in a similar manner, and by a similar articulation. This, however, is much less visible than the others. These motions are wholly independent on one another. Winds and heavy rains make the leaves of the sensitive plant contract and close; but no such effect is produced from slight showers. At night, or when exposed to much cold in the day, the leaves meet and close in the same manner as when touched, folding their upper surfaces together, and in part over each other like scales of tiles, so as to expose as little as possible of the upper surface to the air. The opposite sides of the foliola, or leaves, do not come close together in the night; for when touched they apply themselves closer together. Dr. Darwin kept a sensitive plant in a dark place for some hours after day-break; the leaves and footstalks were collapsed; and on exposing it to the light, above twenty minutes passed before it was expanded. In August, a sensitive plant was carried in a pot out of its usual place into a dark cave, the motion that it received in the carriage shut up its leaves, and they did not open till twenty-four hours afterwards; at this time they became moderately open, but were afterwards subject to no changes at night or morning, but remained three days and nights with their leaves in the same moderately open state. At the end of this time they were brought out again into the air, and there recovered their natural periodical motions, shutting every night and opening every morning, as naturally and as strongly as if the plant had not been in this forced state; and while in the cave it was observed to be very little less affected with the touch than when abroad in the open air. The great heats of summer, when there is open sunshine at noon, affect the plant in some degree like cold, causing it to shut up its leaves a little, but never in any very great degree. The plant, however, is least of all affected about nine A. M., and that is consequently the properest time to make experiments on it. A branch of the sensitive plant, cut off and laid by, retains yet its property of shutting up and opening in the morning for some days, and it holds it longer if kept with one end in water, than if left to dry more suddenly. The leaves only of the sensitive plant shut up in the night, not the branches; and if it be touched at this time, the branches are affected in the same manner as in the day, shutting up or approaching to the stalk or trunk in the same manner and often with more force. It is of no consequence what the substance is with which the plant is touched; but there is a little spot, distinguishable by its paler color in the articulations of its leaves, where the greatest and nicest sensibility is evidently placed. Du Hamel having observed, about the 15th of September in moderate weather, the natural motion of a branch of a sensitive plant, remarked, that at nine A. M. it formed with the stem an angle of 100°; at noon 112°; at three P. M. it returned to 100°; and after touching the branch, the angle was reduced to 90°. Three-quarters of an hour after it had mounted to 112°; and at eight P. M. it descended again without being touched to 90°. The day after, in finer weather, the same branch at eight A. M. made an angle of 135° with the stem; after being touched, the angle was diminished to 80°; an hour after it rose again to 135°; being touched a second time it descended again to 80°; an hour and a half after it had risen to 145°; and upon being touched a third time descended to 135°, and remained in that position till five P. M., when, being touched a fourth time, it fell to 110°. The parts of the plants which have collapsed, afterwards unfold themselves, and return to their former expanded state. The time required for that purpose varies according to the vigor of the plant, the season of the year, the hour of the day, the state of the atmosphere. Sometimes half an hour is requisite, sometimes only ten minutes. The order in which the parts recover themselves

varies in like manner; sometimes it is the common foot-stalk; sometimes the rib to which the leaves are attached; and sometimes the leaves themselves are expanded, before the other parts have made any attempt to recover their former position. If, without shaking the other smaller leaves, we cut off the half of a leaf or lobe belonging to the last pair, at the extremity or summit of a wing, the leaf cut, and its antagonist, that is to say, the first pair, begin to approach each other; then the second, and so on successively, till all the smaller leaves, or lobes of that wing, have collapsed in like manner. Frequently, after twelve or fifteen seconds, the lobes of the other wings, which were not immediately affected by the stroke, shut; whilst the stalk and its wing, beginning at the bottom, and proceeding in order to the top, gradually recover themselves. If, instead of one of the lesser extreme leaves, we cut off one belonging to the pair that is next the foot-stalk, its antagonist shuts, as do the other parts successively, from the bottom to the top. If all the leaves of one side of a wing be cut off, the opposite leaves are not affected, but remain expanded. With some address, it is possible even to cut off a branch without hurting the leaves or making them fall. The common foot-stalk of the winged leaves being cut as far as three-fourths of its diameter, all the parts which hang down collapse, but quickly recover without appearing to have suffered any considerable violence by the shock. An incision being made into one of the principal branches to the depth of half the diameter, the branches betwixt the section and the root will fall down; those above the incision remain as before, and the lesser leaves continue open; but this direction is soon destroyed, by cutting off one of the lobes at the extremity. A whole wing being cut off with precaution, near its insertion into the common foot-stalk, the other wings are not affected by it, and its own lobes do not shut. No motion ensues from piercing the branch with a needle or other sharp instrument. If the end of one of the leaves be burned with the flame of a candle, or by a burning glass, or by touching it with hot iron, it closes up in a moment, and the opposite leaf does the same, and after that the whole series of leaves on each side of the partial or little foot-stalk; then the foot-stalk itself; then the branch or common foot-stalk; all do the same, if the burning has been in a sufficient degree. This proves that there is a very nice communication between all the parts of the plant, by means of which, the burning, which is only applied to the extremity of one leaf, diffuses its influeuce through every part of the shrub. If a drop of aquafortis be carefully laid upon a leaf of the sensitive plant, so as not to shake it in the least, the leaf does not begin to move till the acrid liquor corrodes the substance of it; but at that time, not only that particular leaf, but all the leaves placed on the same foot-stalk, close themselves up. The vapor of burning sulphur has also this effect on many leaves at once, according as they are more or less exposed to it; but a bottle of very acrid and sulphureous spirit of vitriol, placed under the branches unstopped, produces no such effect. Wetting the leaves with spirit of wine has been observed also to have no effect, nor the rubbing oil of almonds over them, though this last application destroys many plants. From the preceding experiments the following conclusions may be fairly drawn:—The contraction of the parts of the sensitive plant is occasioned by an external force, and the contraction is in proportion to the force. All bodies which can exert any force affect the sensitive plant; some by the touch or by agitation, as the wind, rain, &c.; some by chemical influence, as heat and cold. Touching or agitating the plant produces a greater effect than an incision or cutting off a part, or by applying heat or cold. Attempts have been made to explain these curious phenomena. Dr. Darwin, in the notes to his Botanic Garden, lays it down as a principle, that 'the sleep of animals consists in a suspension of voluntary motion; and, as vegetables are subject to sleep as well as animals, there is reason to conclude,' says he, 'that the various actions of closing their petals and foliage may be justly ascribed to a voluntary power; for without the faculty of volition sleep would not have been necessary to them.' Whether this definition of sleep when applied to animals be just, we shall not enquire; but it is evident that the supposed analogy between the sleep of animals and the sleep of plants has led Dr. Darwin to admit this astonishing conclusion, that plants have volition! As volition presupposes a mind or soul, it were to be wished that he had given us some information concerning the nature of a vegetable soul, which can think and will. We suspect, however, that this vegetable soul will turn out to be a mere mechanical or chemical one; for it is affected by external forces uniformly in the same way, its volition is merely passive, and never makes any successful resistance against those causes by which it is influenced.

MIMULUS, in botany, monkey flower, a genus of the angiospermia order, belonging to the didynamia class of plants; natural order fortieth, personatæ.

MINA, or MANEH, in Jewish antiquity, a species of money, which properly signifies one part or ounce. This word occurs in the books of Kings, Chronicles, Ezra, and Ezekiel. This last prophet tells us (xlv. 12), that the minah or maneh was valued at sixty shekels; which in gold make of our English money about £54 15s. and in silver, almost £7.

MINA, in Grecian antiquity, or the attic mina, which is probably that mentioned in the books of the Maccabees and in the New Testament, is valued at 100 drachmæ, or about £2 17s. sterling. There was also a lesser mina, valued at seventy-five drachmæ.

MINAB, a flourishing sea-port of Kirwar, on the Persian Gulf; the territory around abounds in dates, and supplies the neighbouring country with grain. Forage is so plentiful that, during the dry season, the cattle of the adjacent districts are sent in great numbers here to pasture. Long. 56° 40′ E., lat. 27° 8′ N.

MINA'CIOUS, *adj.*
MINAC'ITY, *n. s.*
MIN'ATORY, *adj.*
} Lat. *minax*, *minor* Threatening; abounding in threats; this

both the adjectives signify: minacity, proneness to threaten. Words seldom used.

The king made a statute monitory and *minatory*, towards justices of peace, that they should duly execute their office, inviting complaints against them.

Bacon's Henry VII.

MIN'ARET. Fr. *minaret*; Pers. *minar*. A round tower, generally encircled by balconies, and erected near the mosques in Mohammedan countries, from which the *Muezzin* summons the people to prayer, and announces the hours; bells not being in use among the Mussulmans.

MINAS GERAES, a province of Brasil, extending from north to south from 600 to 700 miles, and about the same distance east and west. It is bounded on the north by Bahia, on the west by Goyaz, and on the south by the Paraibuna, which divides it from the capitania of Rio de Janeiro. From Espiritu Santo and the coast it is separated by an immense chain of mountains, and a country little known. It contains the four districts of St. Joao del Rey, Sabara, Villa Rica, and Cerro do Fio, which produced much more gold a few years after they were discovered than in modern times; though, according to Mr. Mawe, in 1809 the royal fifth amounted to 150 arrobas of 32 lbs. each, or about £1,100,000. Abundance both of gold and diamonds are still, therefore, found; besides which the country yields platina, iron, antimony, bismuth, and chromate of lead. It is rich also in sugar, cotton, wheat, and almost all sorts of grain. In the woods the finest trees are frequently destroyed by the creeping plants; but they abound with trees of various quality, and fit for all purposes. Aromatic shrubs, and occasionally the mulberry and silk-worm, are found, but the latter are not well managed. The palma Christi grows spontaneously; beans, peas, and pulse in general are also fine, as well as pumpkins and cabbages. Here also the rose is extremely fragrant, and in bloom all the year. Varieties of the passion-flower, pinks, carnations, with numberless other flowers, grow in great profusion. The regular military establishment was at a late period 1400 cavalry. Their principal station is Villa Rica. They escort diamonds and treasure to the capital. The regiment enjoys a high reputation, so that numbers are continually offering to enlist. Besides this force there is a militia, in which all the male inhabitants of the capitania are enrolled. The population is estimated at 360,000, of whom 200,000 are negroes; the Indians are not included, but they are not considered numerous.

MINCE, *v. a.* & *n. s.* } Fr. *mincer*. To cut
MINC'INGLY, *adv.* } into small pieces; hence to speak cautiously, or communicate a small portion of information at a time; to speak affectedly: as a neuter verb, to walk in short steps; to walk delicately or affectedly: mincingly, in small parts; not fully or largely.

By her side did sit the bold Sansloy,
Fit mate for such a *mincing* minion,
Who in her looseness took exceeding joy.

Faerie Queene.

Justice requireth nothing *mincingly*, but all with pressed and heaped, and even over-enlarged measure.

Hooker.

She saw Pyrrhus make malicious sport,
In *mincing* with his sword her husband's limbs.

Shakspeare.

Iago,
Thy honesty and love doth *mince* the matter,
Making it light to Cassio. *Id. Othello.*

These gifts,
Saving your *mincing*, the capacity
Of your soft cheveril conscience would receive,
If you might please to stretch it. *Shakspeare.*

I'll turn two *mincing* steps
Into a manly stride. *Id. Merchant of Venice.*

With a good chopping knife *mince* the two capons as small as ordinary *minced* meat. *Bacon.*

A good schoolmaster *minces* his precepts for children to swallow; hanging clogs on the nimbleness of his own soul, that his scholars may go along with him. *Fuller.*

I'll try to force you to your duty:
For so it is, however you *mince* it,
Ere we part I shall evince it. *Hudibras.*

If, to *mince* his meaning, I had either omitted some part of what he said, or taken from the strength of his expression, I certainly had wronged him.

Dryden.

The reeve, miller, and cook, are as much distinguished from each other, as the *mincing* lady prioress and the broad-speaking wife of Bath.

Id. Fables.

What means the service of the church so imperfectly, and by halves, read over? What makes them *mince* and mangle that in their practice, which they could swallow whole in their subscriptions?

South's Sermons.

These, seeing no where water enough to effect a general deluge, were forced to *mince* the matter, and make only a partial one of it, restraining it to Asia.

Woodward.

Revive the wits;
But murder first, and *mince* them all to bits.

Dunciad.

A harlot form soft sliding by,
With *mincing* step, small voice, and languid eye.

Id.

MINCH, an arm of the North Sea, which separates the Isle of Sky from the Long Island.

MINCHA, in the Jewish customs, offerings of meal, cakes, or biscuits, made in the temple. The LXX have sometimes preserved this word in their translation; but, instead of mincha, they read manaa, which doubtless was the received pronunciation in their time. Manaa is used in the same sense, in Baruch i. 10, Levit. ii. 3, &c. See the Septuagint of Jerem. xvii. 26; Dan. ii. 46; 2 Kings viii. 5, 9, xvii. 7, xx. 12; 2 Chron. vii. 7; Nehem. xiii. 5, 9, &c.

MINCIO, a river of Italy, flowing southward from the Garda Lake, and which, after forming the marshes that surround Mantua, falls into the Po, eight miles below that city. Its banks are uncommonly fertile, and celebrated for the descriptions of their scenery by Virgil. Several streams flow from the mountains into the lake; that, commonly considered as the commencement of the Mincio, is the Sarca, rising in the south of the Tyrol.

MIND, *n. s.*, *v. a.* & *v. n.* } Sax. mynd ȝemind; Goth. and
MIND'ED, *adj.* } Swed. *mod*; Dan.
MIND'FUL, } *minde*. Intellect;
MIND'FULLY, *adv* } intellectual power
MIND'LESS, *adj.* } or capacity; hence
MIND'STRICKEN,

thought, sentiment, opinion, judgment, memory: to mind is to mark or heed; attend; put in remembrance; and, as a neuter verb, to incline; be disposed: minded is disposed; inclined; affected: mindful, attentive; careful; having memory (taking of); mindless, without intellectual powers; inattentive; heedless; stupid: mind-stricken, violently moved or affected in mind.

Hast thou a wife after thy *mind?* forsake her not. *Ecclus.*

I am not *high-minded,* I have no proud looks. *Psalm.*

Be of the same *mind* one towards another. *Rom.* xii. 16.

He had been so *mind-stricken* by the beauty of virtue in that noble king, though not born his subject, he ever professed himself his servant. *Sidney.*

His mournful plight is swallowed up unwares,
Forgetful of his own, that *minds* another's cares. *Spenser's Faerie Queene.*

When one of them *mindeth* to go into rebellion, he will convey away all his lordships to feoffees in trust. *Spenser.*

Our question is, Whether all be sin which is done without direction by scripture, and not whether the Israelites did at any time amiss, by following their own *minds,* without asking counsel of God? *Hooker.*

I am a very foolish, fond old man;
I fear I am not in my perfect *mind.* *Shakspeare.*

Being so hard to me that brought your *mind,*
I fear she'll prove as hard to you in telling her *mind.* *Id.*

I will have nothing else but only this;
And now methinks I have a *mind* to it. *Id.*

Let me be punished, that have *minded* you
Of what you should forget. *Id. Winter's Tale.*

We come to know
How you stand *minded* in the weighty difference
Between the king and you. *Id. Henry VIII.*

Cursed Athens, *mindless* of thy worth,
Forget now thy great deeds, when neighbour states,
But for thy sword and fortune, trod upon them. *Shakspeare.*

This word being often used for the soul giving life, is attributed abusively to madmen, when we say that they are of a distracted *mind,* instead of a broken understanding: which word, *mind,* we use also for opinion; as, I am of this or that *mind:* and sometimes for men's conditions or virtues; as, he is of an honest *mind,* or a man of a just *mind:* sometimes for affection; as, I do this for my *mind's* sake; sometimes for the knowledge of principles, which we have without discourse; oftentimes for spirits, angels, and intelligences, &c. *Raleigh.*

They had a *mind* to French Britain; but they have let fall their bit. *Bacon's War with Spain.*

The king knows their disposition; a small touch will put him in *mind* of them. *Bacon.*

A man who cannot *mind* his own business, is not to be trusted with the king's. *Saville.*

God first made angels bodiless, pure *minds;*
Then other things, which *mindless* bodies be:
Last, he made man. *Davies.*

O envy, the corrosive of all ill *minds,* and the root of all desperate actions. *Bp. Hall's Contemplations.*

The proverbs of several nations were much studied by Bishop Andrews, and the reason he gave was, because by them he knew the *minds* of several nations, which is a brave thing. *Selden.*

I acknowledge the usefulness of your directions, and I promise you to be *mindful* of your admonitions. *Hammond.*

We say that learning's endless, and blame fate
For not allowing life a longer date,
He did the utmost bounds of knowledge find,
He found them not so large as was his *mind.* *Cowley.*

Who this observes, may in his body find
Decrepit age, but never in his *mind.* *Denham.*

Waller coasted on the other side of the river, but at such a distance that he had no *mind* to be engaged. *Clarendon.*

Sudden *mind* arose
In Adam, not to let the occasion pass,
Given him by this great conference, to know
Of things above this world. *Milton's Paradise Lost.*

Not then mistrust, but tender love enjoins,
That I should *mind* thee oft, and *mind* thou me. *Milton.*

Whose fellowship therefore unmeet for thee,
Good reason was thou freely should'st dislike,
And be so *minded* still. *Id. Paradise Lost.*

Somewhat always of suspicion and ill opinion will stick in the *minds* of those who have given ear to slander. *Barrow.*

Truth is the special ornament of our *minds,* decking it with a graceful pleasant lustre. *Id.*

If, in the raving of a frantic muse,
And *minding* more his verses than his way,
Any of these should drop into a well. *Roscommon.*

All the arguments to a good life will be very insignificant to a man that hath a *mind* to be wicked, when remission of sins may be had upon such cheap terms. *Tillotson's Sermons.*

If men were *minded* to live virtuously, to believe a God would be no hindrance to any such design, but very much for its advancement. *Tillotson.*

I thought the eternal *mind*
Had made us masters. *Dryden.*

These, and more than I to *mind* can bring,
Menalcus has not yet forgot to sing. *Id.*

Cease to request me; let us *mind* our way;
Another song requires another day. *Id.*

This *minds* me of a cobbling colonel. *L'Estrange.*

These men are of the *mind,* that they have clearer ideas of infinite duration than of infinite space, because God has existed from all eternity; but there is no real matter co-extended with infinite space. *Locke.*

I shall only *mind* him, that the contrary supposition, if it could be proved, is of little use. *Id.*

Pyrrhus is nobly *minded;* and I fain
Would live to thank him. *Philips.*

I desire to *mind* those persons of St. Austin. *Burnet.*

They are the same beams that shine and enlighten, and are apt to scorch too; and it is impossible for a man engaged in any wicked way, to have a clear understanding of it, and a quiet *mind* in it altogether. *South.*

Suppose that after eight years peace he hath a *mind* to infringe any of his treaties, or invade a neighbouring state, what opposition can we make? *Addison.*

As the strong eagle in the silent wood,
Mindless of warlike rage, and hostile care,
Plays round the rocky cliff, or crystal flood. *Prior.*

He is daily called upon by the word, the ministers, and inward suggestions of the Holy Spirit, to attend to those prospects, and *mind* the things that belong to his peace. *Rogers.*

They will put him in *mind* of his own waking thoughts, ere these dreams had as yet made their impressions on his fancy. *Atterbury's Sermons.*

The gods permitting traitors to succeed,
Become not parties in an impious deed;
And, by the tyrant's murder, we may find,
That Cato and the gods were of a *mind*.
Granville.

A wholesome law time out of *mind*,
Had been confirmed by fate's decree. *Swift.*

Whether this last sentiment be right or wrong, I am not accountable; it is an original component feature of my *mind*. *Burns.*

Streams never flow in vain, where streams abound;
How laughs the land with various plenty crowned!
But time, that should enrich the nobler *mind*,
Neglected, leaves a dreary waste behind. *Cowper.*

Come, then, Philander! for thy lofty *mind*
Looks down from far on all that charms the great.
Beattie.

MIN'DANAO. See MAGINDANAO.

MINDEN, a government of Prussia, comprising the north-east part of what has been, since 1815, the province of Westphalia, and made up of the old principalities of Minden, Paderborn, Rittberg, and Corvey, the bailiwick of Reckeberg, and the lordship of Rheda. Its area is about 2000 square miles; its population 330,000. It is divided into thirteen districts, or circles, viz. Minden town, Minden district, Rahden, Bunde, Herford, Bielefeld, Halle, Wiedenbruck, Paderborn, Buren, Warburg, Hoxter, and Brakel. The soil is unequal, but the greatest part is fertile in corn, hemp, and flax. The manufactures are linen and thread. The pasturage is good, and the cattle numerous. The principal minerals are iron, lead, and salt. The chief river the Weser.

MINDEN, a town of Prussia, and the capital of the above government, stands in a pleasant situation, partly on eminences, on the bank of the Weser. While the see of a bishop, it formed a petty republic under his protection, and is a very old town. Over the Weser is a bridge 600 feet in length, and an object of curiosity to architects, for the correct and excellent form of its arches. It has three Lutheran, one Calvinist, and two Catholic churches; a gymnasium, orphan-house, and four hospitals. It has also a Lutheran convent; but the Catholic convent and ancient episcopal chapter, are suppressed. Here are manufactures of woollen, linen, leather, &c. Brewing is also a main pursuit; and the river affords the means of exporting corn and timber. In the vicinity is a number of saw-mills; and the Porta Westphalica, an opening in the neighbouring mountains, through which the Weser passes, is considered an object of curiosity. In 1757 Minden was taken by the French, and retaken the following year by the Hanoverians. In 1759 the French entered once more; but a memorable action, highly honorable to the British troops, being fought in the neighbourhood on the 1st of August, they were obliged to quit it immediately. It was occupied in 1806 by the French, and finally ceded to Prussia in 1814. Inhabitants 6800. Thirty-four miles west from Hanover.

MINDEN, a post town of Montgomery, county of New York, on the south side of the Mohawk; sixty-two W. N. W. Albany, west 448.

MINDORO. See PHILIPPINE ISLANDS.

MINE, *pron poss*. Sax. myn; Teut. ... Fr. *mien;* Lat. *meus*. Of or belonging to me. It was the ancient practice to use my before a consonant, and mine before a vowel, which euphony still requires. Mine is still used also when the substantive precedes: as, this cat is mine.

Jhesus answeride to hem, and seide, *myn* doctrine is not *myn*, but his that sente me. *Wiclif. Jon.* 7.

A friend of *mine* is come to me, and I have nothing to set before him. *Luke.*

While fortune unfaithfull favoured me with light godes, that sorrowful houre, that is to saie, the deth, had almoste drent *myne* hedde; but now for fortune cloudie hath chaunged her decevable chere to mewarde, *myne* unpitous life draweth along ungreable dwellynges. *Calvile.*

Thou art a soul in bliss, but I am bound
Upon a wheel of fire; that *mine* own tears
Do scald like molten lead.
Shakspeare. King Lear.

When a wise man gives thee better counsel, give me *mine* again. *Id.*

That palm is *mine*. *Dryden.*

My son! my son! may kinder stars
Upon thy fortune shine;
And may those pleasures gild thy reign,
That ne'er wad blink on *mine!* *Burns.*

MINE, *n. s. v. n.* & *v. a.*, MI'NER, *n. s.* MIN'ERAL, *n. s.* & *adj.* MIN'ERALIST, MINERAL'OGIST, MINERAL'OGY. Belg. *myn;* Teut. Dan. and Fr. *mine;* Swed. and Span. *mina;* Wel. *mum;* Fr. *mineral;* Lat. *mineralia*. A mine is a place or cavern whence minerals are dug; hence a cavern or hollow place dug under a fortification: to mine is to dig or form mines or burrows; to sap; ruin by mining; hence to destroy by degrees or secretly: a miner is one who digs in or forms mines: a mineral is a fossile substance dug from mines; an inorganic body of the mass of the earth: as an adjective, consisting of fossile substances; a mineralist, is a person working or skilled in minerals: mineralogy, is the science or doctrine of these bodies, and particularly of their classification, see below: a mineralogist one who treats of, or is skilled in this science.

Surely there is a *mine* for the silver.
Job xxviii. 1. *Marg.*

By what eclipse shall that sun be defaced?
What *mine* hath erst thrown down so fair a tower?
What sacrilege hath such a saint disgraced?
Sidney.

Build up the walls of Jerusalem, which you have broken down, and fill up the *mines* that you have digged. *Whitgift.*

It will but skin and film the ulcerous place,
While rank corruption, *mining* all within,
Infects unseen. *Shakspeare. Hamlet.*

She did confess, she had
For you a mortal *mineral;* which, being took,
Should by the minute feed on life, and lingering
By inches waste you. *Id. Cymbeline.*

The *minerals* of the kingdom, of lead, iron, copper, and tin, are of great value. *Bacon.*

They *mined* the walls, laid the powder, and rammed the mouth; but the citizens made a countermine.
Hayward.

The ranging stork in stately beeches dwells;
The climbing goats on hills securely feed;
The *mining* coneys shroud in rocky cells. *Wotton.*

Part, hidden veins digged up, nor hath this earth
Entrails unlike, of *mineral* and stone. *Milton.*

Others to a city strong
Lay siege, encamped; by battery, scale, and *mine*,
Assaulting. *Id.*

The covetous man is a downright servant, a draught horse without bells or feathers, a man condemned to work in *mines*, which is the lowest and hardest condition of servitude. *Cowley.*

Though streighter bounds your fortune did confine,
In your large heart was found a wealthy *mine*. *Waller.*

A workman, to avoid idleness, worked in a groove or *mine*-pit thereabouts, which was little esteemed. *Boyle.*

A *mine*-digger may meet with a gem or a *mineral*, which he knows not what to make of till he shows it a jeweller, or a *mineralist*. *Id.*

The metals and *minerals* which are lodged in the perpendicular intervals do still grow, to speak in the *mineralist's* phrase, or receive additional increase. *Woodward.*

By experience upon bodies in any *mine*, a man may conjecture at the metallick or *mineral* ingredients of any mass found there. *Id.*

Of this various matter the terrestrial globe consists from its surface to the greatest depth we ever dig or *mine*. *Id. Natural History.*

By me king's palaces are pushed to ground,
And *miners* crushed beneath their *mines* are found. *Dryden.*

As the bombardeer levels his mischief at cities, the *miner* busies himself in ruining private houses. *Tatler.*

A man whose great qualities want the ornament of superficial attractions, is like a naked mountain with *mines* of gold, which will be frequented only till the treasure is exhausted. *Rambler.*

Can gold calm passion, or make reason shine?
Can we dig peace, or wisdom, from the *mine*?
Wisdom to gold prefer; for 'tis much less,
To make our fortune, than our happiness. *Young.*

Mine, in the military art, a subterraneous passage, dug under the wall or rampart of a fortification intended to be blown up by gunpowder. It is commonly about four feet square; at the end of this is the chamber of the mine, which is a cavity of about five feet in width and in length, and about six feet in height, and here the gunpowder is stowed. The saucisse of the mine is the train, for which there is always a little aperture left. Two ounces of powder are capable of raising two cubic feet of earth; consequently 200 oz., or 12 lbs. 8 oz., will raise 200 cubic feet, which is only sixteen feet short of a cubic toise, because 200 oz. together have proportionably a greater force than two ounces, as being a united force. All the turnings a miner uses to carry on his mines, and through which he conducts the saucisse, should be well filled with earth and dung; and the masonry in proportion to the earth to be blown up, as three to two. The entrance of the chamber of the mine ought to be firmly shut with thick planks, in the form of St. Andrew's cross, so that the enclosure be secure, and the void spaces shut up with dung or tempered earth. If a gallery be made below, or on the side of the chamber, it must absolutely be filled up with the strongest masonry, half as long again as the height of the earth; for this gallery will not only burst, but likewise obstruct the effect of the mine. The powder should always be kept in sacks, which are opened when the mine is charged, and some of the powder strewed about; the greater the quantity of earth to be raised is, the greater is the effect of the mine, supposing it to have the due proportion of powder. The branches which are carried into the solidity of walls do not exceed three feet in depth, and two feet six inches in width nearly; this sort of mine is fit to blow up the strongest walls. The weight of a cubic foot of powder should be 80 lbs.; one foot one inch cube will weigh 100 lbs.; and one foot two inches and eleven-twelfths, 150 lbs.; and 200 lbs. of powder will be one foot five inches cube; however, there is a diversity in this, according to the quantity of saltpetre in the gunpowder. If, when the mines are made, water be found at the bottom of the chamber, dry planks are laid, on which the powder is placed either in sacks or barrels of 100 lbs. each. The saucisse must have a clear passage to the powder, and be laid in an auget or wooden trough, through all the branches. When the powder is placed in the chamber, the planks are laid to cover it, and others again across these; then one is placed over the top of the chamber, which is shaped for that purpose; between that and those which cover the powder props are placed, which shore it up; some inclining towards the outside, others to the inside of the wall, all the void spaces being filled with earth, dung, bricks, and rough stones. Afterwards planks are placed at the entrance of the chamber, with one across the top, whereon they buttress three strong props, whose other ends are likewise propped against another plank situated on the side of the earth in the branch; which props being well fixed between the planks, with wedges, the branch should then be filled up to its entrance with the forementioned materials. The saucisses which pass through the side branches must be exactly the same length with that in the middle, to which they join; the part which reaches beyond the entrance of the mine is that which conveys the fire to the other three; the saucisses, being of equal length, will spring together. See Fortification.

The force of a mine is always towards the weakest side; so that the disposition of the chamber of a mine does not at all contribute to determine this effect. The quantity of powder must be greater or less in proportion to the greater or less weight of the bodies to be raised, and to their greater or less cohesion; so that we must allow for each cubic fathom of loose earth 9 lbs. or 10 lbs. Of firm earth and strong sand, 11 lbs. or 12 lbs.; of flat clayey earth 15 lbs. or 16 lbs.; of new masonry, not strongly bound, 15 lbs. or 20 lbs.; and of old masonry, well bound, 25 lbs. or 30 lbs. The aperture, or entonnoir of a mine, if rightly charged, is a cone, the diameter of whose base is double the height taken from the centre of the mine. When the mine has been overcharged, its entonnoir is nearly cylindrical, the diameter of the upper extreme not much exceeding that of the chamber. Besides the shock of the powder against the bodies

it takes up, it likewise crushes all the earth that borders upon it, both underneath and sidewise. To charge a mine, so as to have the most advantageous effect, the weight of the matter to be carried must be known; that is, the solidity of a right cone, whose base is double the height of the earth over the centre of the mine; thus, having found the solidity of the cone in cubic fathoms, multiply the number of fathoms by the number of pounds of powder necessary for raising the matter it contains; and, if the cone contains matters of different weights, take a mean weight between them all, always having a regard to their degree of cohesion. As to the disposition of mines, there is but one general rule, viz. that the side towards which one would determine the effect be the weakest; but this varies according to circumstances.

It has been found by experiments that the figure produced by the explosion is a paraboloid, and that the centre of the powder, or charge, occupies the focus. The place where the powder is lodged is called the chamber of the mine, or fourneau. The passage leading to the powder is called the gallery. The line drawn from the centre of the chamber, perpendicular to the nearest surface of the ground, is called the line of least resistance. The pit, or hole, made by springing the mine, is called the excavation.

The fire is communicated to the mine by a pipe, or hose, made of coarse cloth, whose diameter is about one inch and a half, called a saucisson (for the filling of which near half a pound of powder is allowed to every foot), extending from the chamber to the entrance of the gallery, to the end of which is fixed a match, that the miner who sets fire to it may have time to retire before it reaches the chamber.

To prevent the powder from contracting any dampness, the saucisson is laid in a small trough, called an auget, made of boards, three inches and a half broad, joined together lengthwise, with straw in it, and round the saucisson, with a wooden cover nailed upon it.

Some authors call the end of the saucisson that comes within the work, and which is to be set fire to, the foyer, or focus; but, by most people, this is generally understood to be the centre of the chamber, though a different view is taken of the matter in Muller's Treatise.

MINES.

MINES. To carry on all the processes of the mine requires the combination of very considerable skill in several difficult branches of engineering. Most countries in which metallic veins are found, have the strata under the upper soil, consisting of rock of various degrees of hardness, it is therefore an essential part of the miner's art, and what indeed particularly distinguishes him from a common laborer, to be able to break ground of this sort under all the disadvantages of being cramped for room, exposed to constant streams of water, and not unfrequently to unwholesome air.

In Cornwall the workmen generally divide the ground, or rock, into two general classes, one of which they call working ground, and the other is distinguished by the name of shooting ground. The first class includes all such kinds of rock as may be separated or broken by the use only of the pick and wedge, which latter is technically called a gad.

The latter denomination is applied to all rock that is so hard as to require the use of gunpowder, which is bored by tools of steel, and loosened and detached by the explosion of the charges rammed into the holes.

The tools used by the miners of Cornwall and Devon are simple, and in their hands very effective; the form of the principal ones is delineated in MINING, plate I.

The pick, fig. 2, is usually of the shape shown in the drawing, but it is varied a little for some purposes, or for different kinds of rock; the one side is used as a hammer, and is called the poll, it serves to drive the gads, or to detach and loosen projecting parts; the point is steel, carefully tempered, and drawn under the hammer to its proper form, in which considerable nicety is required, as one kind of point will not do for all kinds of ground. The weights of picks are likewise various, according to the situation and circumstances in which they are to be used, but are never very heavy, as experience has fully shown that a rapid succession of smart blows, which may be given by a light tool, produces more effect than a less number from a weighty instrument, which soon tires the workman.

The gads, fig. 3, are wedges of steel, which are driven into crevices of the rock, or into small openings made with the point of the pick, and, in skilful hands, they serve to loosen ground of very dense texture.

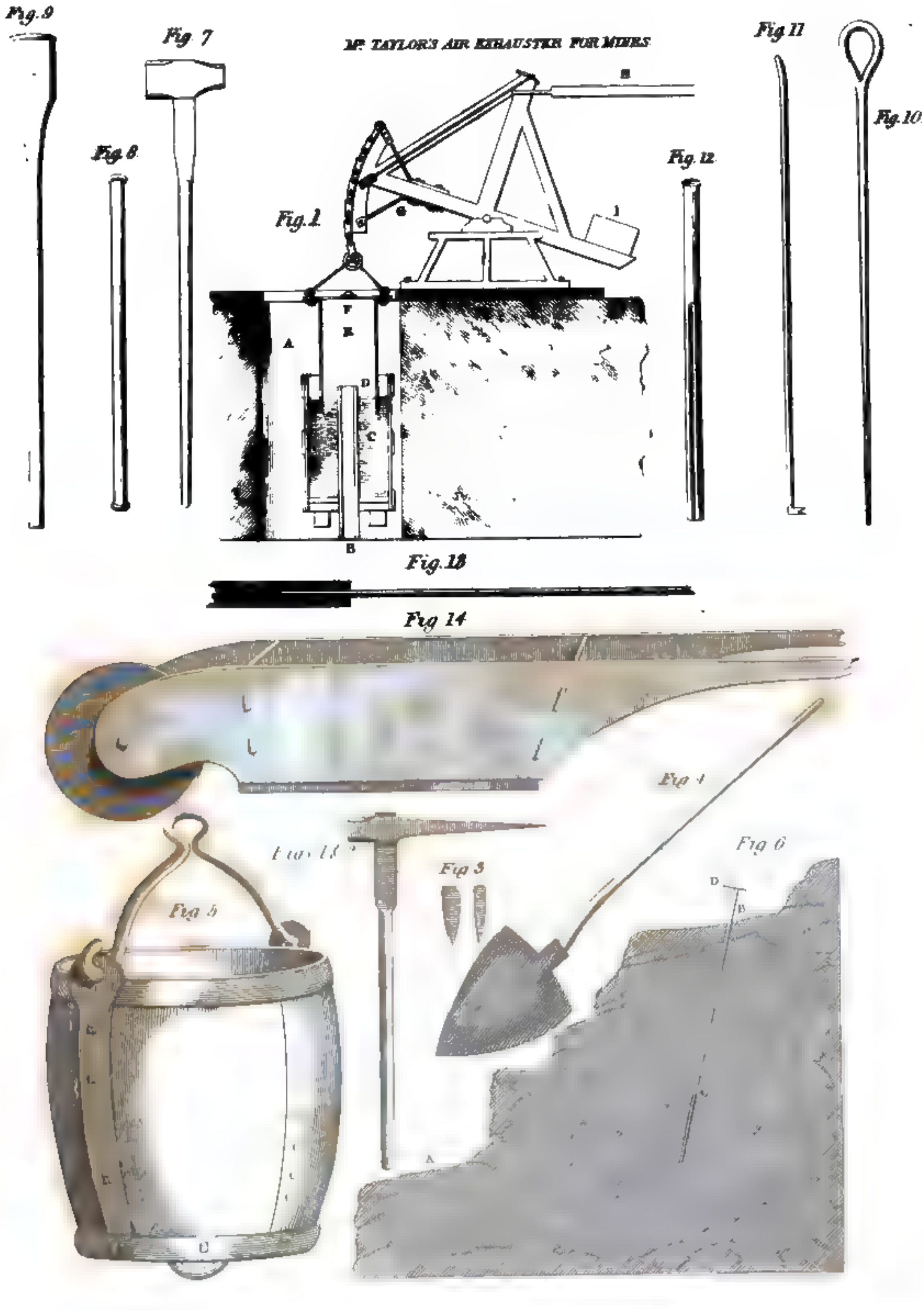
The miners' shovel, fig. 4, has a pointed form, which is necessary to make it possible to force it into or under the coarse and hard fragments of which the waste from a mine principally consists. It is furnished with a long handle somewhat bent, by which a man's power is applied in the most convenient form without stooping the body.

The tools for blasting, or, as it is technically called, shooting, consist of the

	Fig.
Sledge, or mallet,	7
Borer	8
Claying bar	9
Needle, or nail,	10
Scraper,	11
Tamping-bar,	12

Besides these tools there are required a powder-horn, rushes to be filled with powder, occasionally tin cartridges for very wet ground, and paper rubbed with gunpowder, or sometimes grease, for the snufts or fuses.

The borer, fig. 8, is a bar of iron, with a steel end, formed like a thick chisel, and is used by one man holding it in the hole and constantly turning it round, while his comrade strikes the



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upper end with the iron sledge or mallet, fig. 7. The hole is occasionally cleaned out by the scraper, fig. 11, which is an iron rod turned up at one end; or if the ground is very wet, and the hole fills with mud, a stick beat at the extremity till it forms a kind of brush is used, and is called a swab-stick.

Holes for blasting are generally about one inch and a quarter in the bore, and of various depths from ten or twelve inches to three feet; but these, as well as the position and direction in which they are bored, and the charge of powder employed, are subject to the skill and discretion of the miner. The rules by which he is guided are to direct the effort of the explosion to a part of the rock which is most easily displaced, and to proportion the charge to the effect required, so as to shake and loosen a larger portion rather than to blow out a less quantity.

Fig. 6 serves to explain the process of blasting, and represents a section of a hole ready for firing. When the hole is bored it must be made as dry as possible; to do which it is partly filled with good tenacious clay and a round iron bar, nearly fitting the bore of the hole, but somewhat tapering, and called the claying-bar; this is driven in with great violence, which so forces the clay into all the crevices of the rock, that, when the bar is withdrawn, the hole usually remains dry. Where this plan fails, from the great flow of water all round, it becomes necessary to use tin cartridges furnished with a stem or tube through which the powder may be inflamed. A section of one of these cartridges is shown in the plate, fig. 13.

When the hole is dry, either by clay, or otherwise, the proper charge of gunpowder is introduced, and the nail, a small taper rod which ought to be made of copper, is inserted, and reaches to the bottom of the hole; the hole is then ready to receive the tamping, which is the most difficult and dangerous part of the process. It is by this that the gunpowder is confined, and the effect produced; different substances are in use for ramming into the hole for this purpose; that most usually employed is any soft kind of rock, which is free from quartz or flinty matter. Small quantities at a time are introduced into the hole, and rammed very hard by the tamping bar, which is held by one man, and struck with a sledge by another; this is continued until the hole is filled up, and the nail being then drawn out by putting a bar through the eye, and striking it upward, leaves a small perforation or vent for the rush which conveys the fire.

The danger of beating the tamping with iron tools in hard rock, and the many dreadful accidents that frequently happen in this operation, have led to the introduction of contrivances to diminish the risk; but, though some of these have been well adapted for the purpose, yet, as they occasion a little more trouble, they have not been generally adopted by the miner. The simplest and best precaution against danger is to have the nail of copper instead of iron; but, as the former is not so easily made or repaired by the smiths on a mine as the latter, they are not so well liked by the workmen.

The other mode of preventing danger in tamping is by employing substances to confine the gunpowder which require little or no force in beating them into the hole, and as dry sand will often serve the purpose if the rock is not very hard it may be sometimes used; but there are many cases in mines where it will not succeed, and therefore it is seldom attempted. A better substance to confine gunpowder in holes is good tough clay, and this will answer in many cases where sand will fail particularly in wet ground, or in holes that are inclined upwards, it will produce the proper effect in all but very hard rocks, and, if the men could be induced to use it, would undoubtedly tend to the saving many lives.

When the tamping is completely rammed in, and the nail drawn out, a small vent or touch-hole remains, which is to receive the rush to communicate the fire. Any small tube filled with gunpowder will answer for this purpose, but nothing is better or more easily prepared than those in common use. For this purpose, the green rushes which grow in wet marsh lands are chosen, and are selected as long and large as can be had. By making a slit in one side, and drawing along in it the sharp end of a piece of stick, the pith may be taken out very completely, and from the elasticity of the skin of the rush the slit closes again. To fill this tube with gunpowder, the rush is held in one hand so as to pass through a small quantity of powder retained in the palm of the hand; and by opening the slit with a small wedge, and pushing the rush along through the powder at the same time, it is made to embrace a quantity sufficient to communicate inflammation.

To fire the hole, one of these charged rushes is dropped through the vent, and is made steady by a piece of clay; a paper snuff is then fixed to the top, which is so adjusted as to burn a sufficient time to permit the man who fires it to retreat to a proper distance.

Fig. 6 represents a section of a charged hole in a rock. The portion which would be dislodged by the explosion is that part included between A and B. The charge of powder is shown by the white part, which reaches as high in the hole as C: from that point to the surface of the rock the hole is filled with tamping, excepting the small orifice which contains the rush, and which has the snuff affixed at D.

Fig. 14 is a drawing of a wheelbarrow, such as is used under ground for conveying ore and waste to the shafts: these barrows are very simple in their construction, and adapted to the narrow and low levels through which they have to pass. They are usually made all of deal, this timber being the most fitted to the purpose. The wheel has a narrow band of iron round it.

Fig. 5 is an iron bucket, or, as it is called in Cornwall, a kibble, and is used for holding the ore and waste while it is drawn up the shafts by machines, worked by horses, called whims. Kibbles are generally made of wood, having very stout staves, very strongly bound with heavy iron binds or hoops; but as those made with iron plates are to be preferred, and need not much exceed the others in weight, we are glad to be

able to exhibit a drawing of one of the latter of an approved form and construction.

A kibble, such as is used with horse-whims, holds about 300 weight of ore, and 120 kibbles will just clear a cubic fathom of rock.

Miners' work under ground is chiefly divided into sinking, driving, and stoaping.

Sinking is applied to shafts, and to other smaller perpendicular openings from one level to another, usually called winzes.

Shafts are of different dimensions according to the purposes they are designed for; the largest kind is the engine-shaft, in which are generally placed the pumps for draining the mine of water, the ladders for the men, and a part divided off and called the whim-shaft, for the kibbles to pass up and down. Plate II., Mining, will be found to represent a perspective view of a part of the interior of these shafts.

A good engine shaft measures about eight feet by twelve, though some are sunk of larger dimensions. Shafts intended only for hauling ores through, and those for air and foot-ways, may be about six feet by four.

In large shafts, a set of twelve men are usually employed; in smaller ones eight, or even six, are a sufficient complement to keep the work going. They work two or three at a time, and relieve each other every six or eight hours, keeping good the whole twenty-four without intermission. The miners are attended by laborers, or winze men, who haul up the stuff out of their way as it is broken.

Sinking is contracted for by the fathom in depth, and the price therefore varies according to the dimensions of the shaft, as well as according to the hardness of the ground, and the circumstances relating to water, air, &c. A medium price is about £20 a fathom for shafts at some depth from the surface, but some have cost £80, and others are executed as low as £5.

Driving is the term applied to the execution of horizontal passages, which are called adits when used for the conveyance of water near the surface, and levels when made for opening the lode or vein, and forming communications from one shaft to another under ground. Levels ought to be seven feet in height, and two feet and a half wide; by constructing them as high as this, room is given to admit contrivances for ventilation, so that they may be continued to considerable lengths without inconvenience. More than two miners cannot work at one time on the end of a level, and the set of men therefore employed may consist of six, relieving every eight hours, or of four relieving twice in the twenty-four hours, or two men only, who may work as long as circumstances will permit. Driving is paid for by the fathom in length, the height and width being limited; a great variation of prices takes place according as the rock is hard or soft, as work of this sort is done from 10s. a fathom to £30, but about £5 a fathom is the most usual sum paid for this kind of work. These prices here, as well as in sinking shafts, include every expense, as the men pay for their tools, candles, and gunpowder, and likewise are charged with the wheeling the stuff, and hauling it to the surface.

Stoaping is that kind of work which is not included in sinking or driving, but more generally means the breaking away the ground between the levels on the course of the lode or vein, to get the ore. When the men work over head, it is called stoaping the backs, and when the work is carried downwards it is denominated stoaping the bottoms. As both these operations usually take place where ore is obtained, the mode of payment is quite different from that in sinking or driving, and is here called tribute-work, while the other is called tutwork. Tribute means payment by a proportion of the produce, so that the men agree to undertake a particular piece of ground for a certain part of the value of the ore they may procure, when completely merchantable and fit for sale, every operation and process to make it so being conducted at their expense. This mode of contracting is of great advantage to the owners of the mine, as the men have a constant interest concurring with that of their employers, in discovering and procuring the greatest possible quantities of ore, and of returning it in the best and cheapest manner. The proportion paid to the miner, varies of course exceedingly, as many things must be taken into account in estimating a fair tribute for any particular part of a mine, but the contracts are made at so much out of every pound's worth sold, and this fluctuates often in different parts of the same mine from three-pence to fourteen shillings. Nothing shows the necessity of a mine being in the hands of skilful and honorable managers more than the great variation in the prices of all kinds of work carried on in these extensive undertakings.

An engine-shaft is delineated in Mining, plate II.

A, A, A, A, timber-framing put in to support the ground, where, from the rock not being sufficiently hard to stand securely, this precaution becomes necessary. Where boarding is required the planks are driven perpendicularly between the transverse timber and the ground.

B, B, B, B, are dividing-pieces, or beams thrown across the shaft. They serve to support the sides of the shaft, to attach the casing-boards to, which part off the whim-shaft from the foot-way and pump, or engine-shaft (it being usual to consider a large shaft of this kind as divided into the three kinds, each bearing its particular name). And, lastly, the dividing-pieces support the ends of the bearers which carry the pumps, ladders, &c.

C, C, C, C, casing-boards which part off the whim-shaft from the other parts; they are stout planks securely spiked to the dividing-pieces, and, when the shaft is not perpendicular, the kibbles slide upon them.

D, the whim-kibble which conveys up the ore and waste, two of which are employed in a shaft, one going up while the other goes down.

E, F, ladders for the workmen, forming what is usually called the foot-way.

G, saller, a small platform at the foot of each ladder.

H, a column of pumps drawing out of a cistern K, which is supplied by a lower tier of pumps I, furnished at the top with a collar

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launder J, which delivers into the cistern, which likewise receives the stream flowing from the level at L.

M, a set off, which connects the pump rods, so that one set goes into the column I, and another is continued lower to a deeper lift of pumps.

N, N, N, N, bearers, or timber beams, which support the pumps and keep them steady in their places.

The ventilation of mines is so important a subject that we insert at length the following account of a machine invented and applied to that purpose by Mr. Taylor, late the manager of the principal copper mines in Devon; and for which he received the silver medal from the society for the Encouragement of Arts, Manufactures, and Commerce.

'Next in importance to the means employed for draining underground works from water, may be reckoned those which are intended to afford a supply of pure air, sufficient to enable the workmen to continue their operations with ease and safety to themselves, and to keep up, undiminished, the artificial light upon which they depend. It is well known, indeed, to all who are practically engaged in concerns of this kind, that men are frequently obliged to persevere in their labor, where a candle will scarcely burn, and where not only their own health materially suffers in the end, but their employers are put to considerable additional expense by the unavoidable hindrance and the waste of candles and other materials.

'The following remarks are confined to such mines as are worked upon metalliferous veins, according to the practice of this district, and that of the great seat of mining in the neighbouring county of Cornwall, from which indeed ours is borrowed. We find then that a single shaft, not communicating by levels to another, can hardly be sunk to any considerable depth, nor can a level (or, as the foreign miners call it, a gallery) be driven horizontally to any great distance, without some contrivance for procuring currents of air to make up the deficiency of oxygen, which is so rapidly consumed by respiration and combustion in situations like these, where otherwise the whole remains in nearly a stagnant condition.

'We are here unacquainted with the rapid production of those gases which occasionally in the collieries are the cause of such dreadful effects; such as hydrogen gas, or the fire-damp, carbonic acid, or the choke-damp; the inconvenience we experience takes place gradually as we recede from the openings to the atmosphere, and seems to arise solely from the causes which have been before assigned, though it is found to come on more rapidly in certain situations than in others.

'The most obvious remedy, and that which is most frequently resorted to, is the opening a communication either to some other part of the mine, or to the surface itself; and as soon as this is done, the ventilation is found to be complete, by the currents which immediately take place, often with considerable force, from the different degrees of temperature in the subterranean and upper atmospheres; and these currents may be observed to change their directions as the temperatures alternate.

'The great objection to this mode of curing the evil is the enormous expense with which it is most commonly attended. In driving a long level, or tunnel, for instance, it may happen to be at a great depth under the surface, and the intervening rock of great hardness; in such a case every shaft which must be sunk upon it for air alone, where not required (as often they might not) to draw up the waste, would cost several hundred pounds; or in sinking a shaft it may be necessary, at an expense not much less, to drive a level to it from some other for this purpose alone.

'To avoid this, recourse has been had to dividing the shaft or level into two distinct parts, communicating near the part intended to be ventilated, so that a current may be produced in opposite directions on each side the partition; and this, where room is to be spared for it, is often effectual to a certain extent. It is found, however, to have its limits at no very great distance, and the current at best is but a feeble one, from the nearly equal states of heat in the air on each side. The only scheme besides these has hitherto been to force down a volume of purer air, through a system of pipes placed for the purpose, and a variety of contrivances have been devised for effecting this; most of them are so old that they may be found described in Agricola's work, De Re Metallicâ. The most common are by bellows worked by hand; by boxes or cylinders of various forms placed on the surface with a large opening against the wind, and a smaller one communicating with the air-pipes by a cylinder and piston working in it, which when driven by a sufficient force has great power. But the cheapest and most effectual scheme for this purpose, where circumstances will admit of its being applied, is one which was adopted some time since in the tunnel of the Tavistock canal. It is by applying the fall of a stream of water for this purpose, and it has been long known that a blast of considerable strength may may be obtained in this manner, which has the advantage of being constant and self-acting. The stream, being turned down a perpendicular column of pipes, dashes in at a vessel so contrived as to let off the water one way, with an opening at another part for the air, which, being pressed into it by the falling water, may be conveyed in any direction, and will pass through air-pipes with a strong current, which will be found efficacious in ventilating mines in many instances, as it has likewise, in some cases, been sufficient for urging the intensity of fires for the purposes of the forge. It is easily procured where a sufficient fall is to be had; and the perpendicular column can be so fixed as that the water from the bottom may pass off, while the air is forced into a pipe branching from the air-vessel, and which is to be continued to the part of the mine where the supply of fresh air is required.

'It has been found, however, that the forcing into vitiated air a mixture of that which is purer, even when the best means are used, though

a measure which affords relief, is not, in bad cases, a complete remedy; and, where the operation depends on manual labor, or any means that are not unremitted in their action, it becomes quite ineffectual. The foul air, charged with the smoke of gunpowder used in blasting, and which it strongly retains, is certainly meliorated by the mixture of pure air, but is not removed. While the blast continues, some of it is driven into the other parts of the mine; but, when the influx of pure air ceases, it returns again: or if, during the influx of pure air, a fresh volume of smoke be produced by explosions, which are constantly taking place, it is not until some time afterwards that it becomes sufficiently attenuated for the workmen to resume their stations with comfort.

'A consideration of these circumstances led me to the supposition that the usual operation of ventilating engines ought to be reversed, to afford all the advantages that could be desired; that, instead of using the machines which serve as condensers, exhausters should be adopted; and thus, instead of forcing pure air into that in a vitiated state, a complete remedy could only be had by pumping out all that was impure as fast as it became so.

'Many modes of doing this suggested themselves, by the alteration of the machines commonly applied, and by producing an ascending stream of air through pipes by a furnace constructed for the purpose. The latter mode would, however, have been here expensive in fuel as well as in attendance; and the others required power to overcome the friction of pistons, and so on, or considerable accuracy in construction.

'At length the machine was erected of which the annexed is a drawing; which, while it is so simple in construction, and requires so small an expense of power, is so complete in its operation, and its parts are so little liable to be injured by wear, that nothing more can be desired where such an one is applied. This engine bears considerable resemblance to Mr. Pepys's gazometer, though this did not occur to the inventer until after it was put to work. It will readily be understood by an inspection of the engraving, plate III., where the shaft of the mine is represented at A; and it may here be observed that the machine will be as well placed at the bottom of the shaft as at the top, and, in either case, it is proper to fix it upon a floor, which may prevent the return of the foul air into the mine, after being discharged from the exhauster: this floor may be furnished with a trap door, to be opened occasionally for the passage of buckets through it.

'B, the air-pipe from the mine passing through the bottom of the fixed vessel or cylinder C, which is formed of timber, and bound with iron hoops; this is filled with water nearly to the top of the pipe B, on which is fixed a valve opening upwards at D.

'E, the air or exhausting-cylinder made of cast-iron, open at the bottom and suspended over the air-pipe, immersed some way in the water. It is furnished with a wooden top, in which is an opening fitted with a valve likewise opening upwards at F.

'The exhausting-cylinder has its motion up and down given to it by the bob G, connected to any engine by the horizontal rod H, and the weight of the cylinder is balanced, if necessary, by the counterpoise I.

'The action is obvious.—When the exhausting-cylinder is raised, a vacuum would be produced, or rather the water would likewise be raised in it, were it not for the stream of air from the mine rushing through the pipe and valve D. As soon as the cylinder begins to descend, this valve closes, and prevents the return of the air which is discharged through the valve F.

'The quantity of air exhausted is calculated of course from the area of the bore of the cylinder, and the length of the stroke.

'The dimensions which have been found sufficent for large works are as follow:—

'The bore of the exhausting-cylinder two feet.

'The length six feet, so as to afford a stroke of four feet.

'The pipes which conduct the air to such an engine ought not to be less than six-inch bore.

'The best rate of working is from two to three strokes a minute; but, if required to go much faster, it will be proper to adapt a capacious air-vessel to the pipes near the machine, which will equalise the current pressing through them.

'Such an engine discharges more than 200 gallons of air in a minute; and I have found that a stream of water supplied by an inch and a half bore falling twelve feet is sufficient to keep it regularly working.

'A small engine to pump out two gallons at a stroke, which would be sufficient in many cases, could be worked by a power equal to raising a very few pounds weight, as the whole machine may be put into complete equilibrium before it begins to work, and there is hardly any other friction to overcome but that of the air passing through the pipes.

'The end of the tunnel of the Tavistock Canal, which it was my object to ventilate, was driven into the hill at a distance of nearly 300 yards from any opening to the surface; and being at a depth of 120 yards, and all in hard schistus rock, air-shafts would have been attended with an enormous expense; so that, the tunnel being a long one, it was most desirable to sink as few as possible, and, of course, at considerable distances from each other. Thus a ventilating machine was required which should act with sufficient force through a length of nearly half a mile; and, on the side of the hill where it first became necessary to apply it, no larger stream of water to give it motion could be relied on than such a one as is mentioned after the description of the engine, and even that flowed at a distance from the shaft where the engine was to be fixed, which made a considerable length of connexion-rods necessary.

'Within a very short time after the engine began to work, the superiority of its action over those formerly employed was abundantly evident. The whole extent of the tunnel, which had been uninterruptedly clouded with smoke for some months before, and which the air that was forced

in never could drive out, now became speedily so clear that the day-light and even objects at its mouth were distinctly seen from its furthest end. After blowing up the rock, the miners could instantly return to the place where they were employed, unimpeded by the smoke, of which no appearance would remain under-ground in a very few minutes, while it might be seen to be discharged in gusts, from the valve at the top of the shaft. The constant current into the pipe at the same time effectually prevented the accumulation of air unfit for respiration. The influx of air, from the level into the mouth of the pipe, rushes with such force as instantly to extinguish the flame of a large candle; and any substance applied, so as to stop the orifice, is held tight by the outward pressure.

'It is now more than two years since the machine was erected, and it has been uninterruptedly at work ever since, and without repair. The length of the tunnel has been nearly doubled, and the pipes, of course, in the same proportion, and no want of ventilation is yet perceptible.

'Two similar engines have been since constructed for other parts of the same tunnel, and have in every respect answered the purpose for which they were designed.

'The original one is worked by the small stream of water before-mentioned, by means of a light overshot-wheel twelve feet in diameter, and about six inches in breast. The two others are attached to the great overshot-wheel which pumps the water from the shafts which are sinking upon the line; and, as their friction is comparatively nothing, this may be done in any case, with so little waste of power for this purpose as not to be an object of consideration, even if the power be derived from more expensive means.

'The size of the exhauster may always be proportioned to the demand for air; and, by a due consideration of this circumstance, this engine may be effectually adapted not only to mines and collieries, but also to manufactories, workhouses, hospitals, prisons, ships, and so on.

'Thus, if it were required to ventilate a shaft of a mine, or a single level, which is most frequently the case, where three men are at work at one time, and we allow that those three men vitiate each twenty-seven cubic inches and a half of air per minute (as determined by the experiments of Messrs. Allen and Pepys), and allowing further that their candles vitiate as much as the men, there will be six times twenty-seven and a half cubic inches of air to be drawn out in a minute, equal to 165.

'Now a cylinder five inches in diameter, working with a stroke at nine inches, will effect this by one stroke in a minute; though it would certainly be advisable to make it larger.

'Not being practically acquainted with collieries, or mines that suffer from peculiar gases that are produced in them, I cannot state, from actual experiment, what effect this machine might have in relieving them; but it must appear evident, to every person at all acquainted with the first principles of pneumatics, that it must do all that can be wished, as it is obvious that such a machine must in a given time pump out the whole volume of air contained in a given space, and thus change an impure atmosphere for a better one. And in constructing the machine it is only necessary to estimate the volume of gas produced in a certain time, or the capacity of the whole space to be ventilated. It is easy to judge how much more this must do for such cases as these, than such schemes as have lately been proposed of exciting jets of water, or slaking lime, both of which projects, likewise, must fail when applied; as one of them has when applied to the case of hydrogen gas. But with such a machine as this, if the dreadful effects of explosions of this air are to be counteracted, it may be done by one of sufficient size to draw off the air as fast as it is generated; and by carrying the pipes into the elevated parts of the mine, where from its lightness it would collect. If, on the other hand, it is desired to free any subterraneous work from the carbonic acid gas, it may as certainly be done by suffering the pipe to terminate in the lower parts, where this air would be directed by its gravity.

'In workhouses, hospitals, manufactories, &c., it is always easy to calculate the quantity of air contained in any room, or number of rooms, and easy to estimate how often it is desirable to change this in a certain number of hours, and to adjust the size and velocity of the engine accordingly. Where this change of foul air for pure is to take place in the night, means for working the machine may be provided by pumping up a quantity of water into a reservoir of sufficient height to admit of its flowing out during the night in a small stream, with sufficient fall, so as to give motion to the engine; or by winding up a weight of sufficient size, or by many other means which are easily devised.

'If, for instance, a room in which fifty persons slept was eighty feet long, twenty wide, and ten high, it would contain 16,000 cubic feet of air, and, if this was to be removed twice in eight hours, it would require a cylinder of thirty inches diameter, working with a four-feet stroke four times in a minute, to do it; or nearly that. Such a cylinder could be worked by the descent of ten gallons of water ten feet in a minute; or, for the whole time, by eighty hogsheads falling the same height.

'But this is a vast deal more than could be required, as the fifty people would in eight hours vitiate only 3000 gallons of air, which could be removed by 150 strokes of a cylinder, twelve inches diameter, with a four feet stroke, which would not require an expenditure of more than 1500 gallons of water properly applied, or about twenty-eight hogsheads.'

Mr. Price, in his Treatise on the Cornish mines, observes, 'that the comparative smallness of the largest fissures to the bulk of the whole earth is really wonderful. In the finest pottery we can make, by a microscopic view, we may discover numerous cracks and fissures, so small as to be impenetrable by any fluid, and impervious to the naked eye;' as, by the laws of nature originally imposed by the Creator, it happens that matter cannot contract itself into solid large masses, without leaving fissures between them, and yet the very fissures are as necessary and

useful as the strata through which they pass. They are the drains that carry off the redundant moisture from the earth; which, but for them, would be too full of fens and bogs for animals to live, or plants to thrive on. In these fissures, the several ingredients which form lodes, by the continual passing of waters, and the menstrua of metals, are brought out of the adjacent strata, collected and conveniently lodged in a narrow channel, much to the advantage of those who search for them; for if metals and minerals were more dispersed, and scattered thinly in the body of the strata, the trouble of finding and getting at them would be endless, and the expense of procuring them exceed the value of the acquisition. The insides of the fissures are commonly coated over with a hard, crystalline, earthy substance or rind, which very often, in the breaking of hard ore, comes off along with it, and is commonly called the capels or walls of the lode: but Mr. Price is of opinion that the proper walls of the lode are the sides of the fissure itself, and not the coat, which is the natural plaster upon those walls, furnished perhaps by the contents of the fissures, or from oozings of the surrounding strata. The breadth of a lode is known by the distance betwixt the two incrusted sides of the stones of ore; and, if a lode yields any kind of ore, it is a better sign that the walls be regular and smooth, or at least that one of them be so, than otherwise; but few of these fissures have regular walls until they have been sunk down some fathoms. Thus the inner part of the figure, in which the ore lies, is all the way bounded by two walls of stone, which are generally parallel to one another, and include the breadth of the vein or lode. Whatever angle of inclination some fissures make in the solid strata, at their beginning, they generally continue to do the same all along. Some are small at their upper part, and wide underneath, and vice versâ. Their breadth, as well as depth, varies much; for, though a fissure may be many fathoms wide in one place, yet a little further east or west it may not be one inch wide. This excessive variation happens generally in very compact strata, when the vein is squeezed, as it were, through hard rocks which seem to straiten it. A true vein, however, is never entirely obliterated, but always shows a string of metallic ore, or of a veiny substance; which often serves as a leader for the miners, until it sometimes leads them to a richly impregnated part. Their length is in a great measure unlimited. The richest state for copper, according to Mr. Price, is from forty to eighty fathoms deep: for tin from twenty to sixty; and, though a great quantity of either may be raised at eighty or 100 fathoms, yet 'the quality is often too much decayed and dry for metal.' He says that the fissures or veins of the Cornish mines extend from east to west; or, more properly, one end of the fissure points west and by south, or west and by north; while the other tends east and by south, or east and by nórth. Thus they frequently pass through a considerable tract of country with few variations in their direction, unless interrupted by some intervening cause. But, besides this east and west direction, there is what the miners call the underlying or hade of the vein or lode, viz. the deflection or deviation of the fissure from its perpendicular line, as it is followed in depth like the slope of the roof of a house, or the descent of the steep side of a hill. This slope is generally to the north or south; but varies much in different veins, or sometimes even in the same vein; for it will often slope or underlie a small space in different ways, as it may be forced by hard strata on either side. Some of the fissures do not vary much from a perpendicular, while some deviate more than a fathom; that is, for every fathom they descend in perpendicular height, they deviate likewise as much to the south or north. Others differ so much from the perpendicular that they assume a position almost horizontal; whence they are also called horizontal or flat lodes, and sometimes lode plots. Another kind has an irregular position with regard to the rest; widening horizontally for a little way, and then descending perpendicularly almost like stairs, with only a small string or leader to follow after; and thus they alternately vary and yield ore in several flat horizontal fissures. This, by the Cornish tinners, is called (but in Mr. Price's opinion erroneously) a floor or squat; which, properly speaking, is a hole or chasm impregnated with metal, making no continued line of direction or regular walls. Neither does a floor of ore descend to any considerable depth; for underneath it there appears no sign of a vein, either leading directly down or any other way. This kind of vein is very rare in Britain. The fissures most common in Britain are the perpendicular and inclined, to whatever point their direction be. The perpendicular and horizontal fissures (Mr. Price says) remain little altered from their first position, when they were formed at the induration of the strata immediately after the waters left the land. The perpendicular fissures are more commonly situated in level ground, at a distance from hills, and from the sea shore; but with regard to the latter, the upper and under masses of strata differ in their solidity and properties. 'Hence (says Mr. Price) it is plain, that inclined fissures owe their deflection to some secondary cause, violence, or subsidence of the earth; for, though perpendicular fissures are seldom to be seen, yet such as are inclined at very considerable depths become more and more perpendicular, as the more central strata, by reason of the vast superincumbent weight, do not seem so likely to be driven out of their position as those which lie nearer the surface.' The fissures are often met with fractured as well as inclined; the reason of which, Mr. Price thinks, has been a subsidence of the earth, from some extraordinary cause. 'The original position, says he, must have been horizontal, or parallel to the surface of the earth: but we often find these strata very sensibly declined from the first position; nay, sometimes quite reversed, and changed into perpendicular. When we see a wall lean, we immediately conclude that the foundation has given way, according to the angles which the wall makes with the horizon; and, when we find the like declination in strata, we may conclude, by parity of reason, that there has been a like failure of what supported them,

in proportion to that declination; or that whatever made the strata to fall so much awry, must also cause every thing included in those strata to fall proportionably. Wherever the greatest subsidence is to the north the top of the lode or fissure will point to the north, and of consequence underlie to the south, and vice versâ: the slide or heave of the lode manifests the greater subsidence of the strata; but the same lode is frequently fractured and heaved in several places: all of which, by due observation, will show us they were occasioned by so many several shocks or subsidences, and that the strata were not unfooted, shaken, or brought to fall once only or twice, but several times.'

Mr. Price observes that, though the metallic veins generally run from east to west, they are frequently intersected by veins or lodes of other matters, which run from north to south. Some of these cross veins contain lead or antimony, but never tin or copper. Sometimes one of these unmetallic veins intersects the true one at right angles, sometimes obliquely; and sometimes the mixture of both is so intimate that the most expert miners are at a loss to discover the separated part of the true vein. When this last is intercepted at right angles it is moved, either north or south, a very little way, perhaps not above a fathom; in which case, having worked to a small distance in one of these directions, if they find themselves disappointed, they turn to the other hand, and seldom fail of meeting with what they expected. Sometimes they are directed in their search by the pointing of a rib or string of the true vein; but, when the interruption happens in an oblique direction, the difficulty of finding the vein again is much greater. When two metallic veins near each other run in an oblique direction, and meet together, they commonly produce a body of ore at the place where they intersect; and, if both are rich, the quantity will be considerable; but if one be poor and the other rich, then both are either enriched or impoverished by the meeting. After some time they separate again, and each will continue its former direction near to the other; but sometimes, though rarely, they continue united. It is a sign of a poor vein when it separates or diverges into strings; but, when several of them are found running into one, it is accounted a promising sign. Sometimes there are branches without the walls of the vein in the adjacent strata, which often come either obliquely or transversely into it. If these branches are impregnated with ore, or if they underlie faster than the true vein, that is, if they dip deeper into the ground, then they are said to overtake or come into the lode, and to enrich it; or, if they do not, then they are said to go off from it, and to impoverish it. But neither these nor any other marks, either of the richness or poverty of a mine, are to be entirely depended upon; for many mines, which have a very bad appearance at first, turn out extremely well afterwards; while others, which in the beginning seemed very rich, turned gradually worse; but in general, where a vein has a very bad appearance at first, it will be imprudent to be at much expense with it. Veins of metal are often so compressed betwixt hard strata that they are not an inch wide; nevertheless, if they have a string of good ore, it will generally be worth while to pursue them; and they often turn out well at last. It is an encouragement to go on, if the leaders of ore enlarge either in width or depth as they are worked; but it is a bad sign if they continue horizontal without inclining downwards; though it is not proper always to discontinue the working of a vein which has an unfavorable aspect at first. Veins of tin are worth working when only three inches wide, provided the ore be good: and copper ores, when six inches wide, will pay very well for the working. Some of the great mines, however, have very large veins, with a number of other small ones very near each other. There are also veins crossing one another sometimes met with, which are called contras, vulgarly caunters. Sometimes two veins run down into the ground in such a manner that they meet in the direction of their depths; in which case the same observations apply to them which are applicable to those that meet in a horizontal direction. Sometimes a vein suddenly disappears, by becoming narrower, or of worse quality; which by the miners is called a start or leap, and is common in the mines of Cornwall. In one day they may thus be disappointed in the working of a rich vein of tin, and have no further sign of any thing to work upon: at the fractured extremity of their vein they perceive a body of clay or other matter; and the method of recovering their vein is to drive on their work in the direction of the former part, so that their new work shall make the same angle with the clay that the other part of the vein does. Sometimes they sink a shaft down from the surface; but it is generally a matter of difficulty to recover a vein when thus lost.

The method of *discovering mines* is a matter of so much difficulty that it seems surprising how those who were totally unacquainted with the nature of metals first thought of digging them out of the earth. Lucretius says, the discovery was made by the conflagration of woods, which melted the veins of metal in the earth beneath them; and Aristotle tells us that, some shepherds in Spain having set fire to the woods, the earth was thus heated to such a degree that the silver near the surface of it melted and flowed into a mass; and that in a short time the metallic mass was discovered by the rending of the earth in the time of an earthquake. The same story is told by Strabo, who ascribes the discovery of the mines of Andalusia to this accident. The discovery of gold has been ascribed to Mercury, Cadmus, Thoas of Thrace, Piseus king of Italy, Cæacus, and other fabulous heroes; but Æschylus attributes the discovery of all the metals to Prometheus. The copper mines in Cyprus were first discovered by Cinyras, the son of Agriopas; and Hesiod ascribes the discovery of the iron mines of Crete to the Cretan Dactyli Idæi. The extraction of lead or tin from its ore, in the island of Cassiteris, according to several ancient authors, was discovered by Midacritus. Moses, however, ascribes the invention of brass and iron, or at least of the methods of working them,

to Tubal Cain, before the flood. In later times, mines have been often discovered by accident; as in sea-cliffs, among broken craggy rocks, by the washing of the tides or floods, also by irruptions and torrents of water issuing out of hills and mountains, and sometimes by the wearing of high roads. Mr. Price mentions, among other methods by which mines have been discovered, one by fiery corruscations, ignes fatui, or falling stars, and says, 'the tinners generally search with uncommon eagerness the ground over which these jack-a-lanterns have appeared.' But this mode of judging of mines has now lost all credit. Mines are now most commonly discovered by investigating the nature of such veins, ores, and stones, as seem most likely to turn to account: but there is a particular sagacity, or habit of judging from particular signs, which can be acquired only by long practice. Mines, especially those of copper, may also be discovered by the harsh and disagreeable taste of the waters which issue from them; though this only happens when the ore lies above the level of the water; for it does not seem likely that the taste of the ore could ascend, unless we were to suppose a pond or lake of water standing above it. The presence of copper in any water is easily discovered by immerging in it a bit of polished iron, which will thus instantly be turned of a copper color, by the precipitation of the metal upon it. A candle, or piece of tallow, put into water of this kind, will in a short time be tinged green. Another, and still more wonderful method of discovering mines, is said to be by the virgula divinatoria, or divining-rod; which, however incredible the stories related concerning it may be, is still relied on by some, and among others by Mr. Price. It is not known who was the inventor of this method; but Agricola supposes that it took its rise from the magicians, who pretended to discover mines by enchantment. No mention is made of it, however, before the eleventh century, since which time it has been in frequent use; and the Corpuscular Philosophy has even been called in to account for it. It is said to be performed in consequence of a certain unaccountable attraction which the metals have for rods of nut or other fruit-trees. But the account given by Price, which he had from a Mr. Cookworthy of Plymouth, who is said to have had the first information concerning this rod from one captain Ribera, a deserter from the Spanish service in queen Anne's reign, and afterwards captain-commandant in the garrison of Plymouth, is so very incredible, not to add unintelligible and unphilosophical, that we think it unnecessary to quote it; and shall therefore leave it to be investigated from Mr. Price's work, by such of our readers (if any such there be) as have faith in the obsolete and occult sciences of astrology, enchantment, and magic. Another, and very ancient mode of discovering mines, but extremely difficult and precarious, is that called shoding; that is, tracing them by loose stones, fragments, or shodes, which may have been separated and carried off to a considerable distance from the vein, and are found by chance in running waters, on the surface of the ground, or a little under. 'When the tinners,' says Mr. Price, 'meet with a loose single stone of tin ore, either in a valley, or in ploughing or hedging, though at 100 fathoms distance from the vein it came from, those who are accustomed to this work will not fail to find it out. They consider that a metallic stone must originally have appertained to some vein, from which it was severed and cast at a distance by some violent means. The deluge, they suppose, moved most of the loose earthy coat of the globe, and in many places washed it off from the upper towards the lower grounds, with such a force that most of the backs or lodes of veins which protruded themselves above the fast were hurried downwards with the mass: whence the skill in this part of their business lies much in directing their measures according to the situation of the surface.' Afterwards, however, our author complains, that this art of shoding, as he calls it, is in a great measure lost. The following account of a method of finding silver mines, by Alonzo Barba, seems to be similar to that of shoding:—'The veins of metal,' says he, 'are sometimes found by great stones above ground; and if the veins be covered they hunt them out after this manner: viz. taking in their hands a sort of mattock, which has a steel point at one end to dig with, and a blunt head at the other, wherewith to break stones, they go to the hollows of the mountains, where the current of rain water descends, or to some other part of the skirts of the mountains, and there observe what stones they meet with, breaking in pieces those that seem to have any metal in them; whereof they find many times both middling sort of stones and small ones also of metal. Then they consider the situation of that place, and whence these stones can tumble, which of necessity must be from higher ground, and follow the tract of them up the hill as long as they can find any of them,' &c. Another way, says Mr. Price, of discovering lodes, is by working drifts across the country, as we call it, that is, from north to south, and vice versâ. I tried the experiment in an adventure under my management, where I drove all open at grass about two feet in the shelf, very much like a level to convey water upon a mill-wheel; by so doing I was sure of cutting all lodes in my way; and did accordingly discover five courses, one of which has produced above 180 tons of copper-ore, but the others were never wrought upon. This method of discovering lodes is equally cheap and certain; for 100 fathoms in shallow ground may be driven at 50s. expense.' In that kind of ground called by our author feasible, and which he explains by the phrase tender-standing, he tells us that 'a very effectual, proving, and consequential way is, by driving an adit from the lowest ground, either north or south, whereby there is a certainty to cut all lodes at twenty, thirty, or forty fathoms deep, if the level admits of it. In driving adits or levels across, north or south, to unwater mines already found, there are many fresh veins discovered, which frequently prove better than those they were driving to.'

After the mine is found, the next thing to be considered is, whether it may be dug to advantage. To determine this we are duly to

weigh the nature of the place, and its situation, as to wood, water, carriage, healthiness, and the like; and compare the result with the richness of the ore, the charge of digging, stamping, washing, and smelting. The form and situation of the spot should be well considered. A mine must either happen, 1. In a mountain; 2. In a hill; 3. In a valley; or, 4. In a flat. But mountains and hills are dug with much greater ease and convenience, chiefly because the drains and burrows, that is, the adits or avenues, may be here readily cut, both to drain the water, and to form gangways for bringing out the lead, &c. In all the four cases we are to look out for the veins which the rains or other accidental thing may have laid bare; and, if such a vein be found, it may often be proper to open the mine at that place, especially if the vein prove tolerably large and rich; otherwise the most commodious place for situation is to be chosen for the purpose, viz. neither on a flat, nor on the tops of mountains, but on the sides. The best situation for a mine is a mountainous, woody, wholesome spot, of a safe and easy ascent, and near a navigable river. The places abounding with mines are generally healthy, as standing high, and every where exposed to the air; yet some places where mines are found prove poisonous, and can upon no account be dug, though ever so rich: the way of examining a suspected place of this kind is to make experiments upon brutes, by exposing them to the effluvia, to discover their effects. Devonshire and Cornwall, where there are many mines of copper and tin, are very mountainous; which gives an opportunity to make adits or subterraneous drains to some valley at a distance, by which to carry off the water from the mine, which otherwise would prevent them from getting the ore. These adits are sometimes carried a mile or two, and dug at an experse of from £2000 to £4000, especially where the ground is rocky; and yet they find this cheaper than to draw up the water out of the mine quite to the top, when the water runs in plenty and the mine is deep. Sometimes, indeed, they cannot find a level near enough, to which an adit may be carried from the very bottom of the mine; yet they find it worth while to make an adit at half the height to which the water is to be raised, thereby saving half the expense. The late Mr. Costar, considering that sometimes from small streams, and sometimes from little springs or collections of rain water, one might have a good deal of water above ground, though not a sufficient quantity to turn an overshot-wheel, thought that, if a sufficient fall might be had, this collection of water might be made useful in raising the water in a mine to the adit, where it may be carried off. But now the most general method of draining mines is by the steam engine. See Steam Engine, Metallurgy, and Mineralogy.

MINEHEAD, an ancient seaport and market-town of Somersetshire, with a harbour in the Bristol Channel, near Dunster Castle, formerly much frequented by passengers to and from Ireland. It was incorporated by queen Elizabeth, with great privileges, on condition of keeping the quay in repair; but its trade falling off, the quay was neglected, and the privileges were lost. A statute was obtained in the reign of William III. for recovering the port, and keeping it in repair; and the quay was rebuilt. In pursuance of another act, a new head was built to the quay, and the beach cleared. It was formerly governed by a portreve, and now by two constables chosen annually at a court-leet, held by the lord of the manor. Its chief trade is with Ireland, whence about forty vessels used to come hither in a year with wool. The market is on Wednesday, and fair on Whitsun-Wednesday. Minehead is thirty-one miles north of Exeter, and 163 west by south of London.

Mineral Acids. See Acids and Chemistry.

Mineral Alkali. See Alkali and Chemistry.

Mineral Pitch. See Chemistry.

MINERAL WATERS.

Mineral Waters, or Mineral Springs. All waters naturally impregnated with any heterogeneous matter which they have dissolved within the earth may be called mineral waters, in the most extensive meaning of that name; which might therefore comprehend almost all those that flow within or upon the earth; for almost all these contain some earth or selenites. But waters containing only earth or selenites are not generally called mineral, but hard or crude waters. These, when chemically analysed, show no marks of an acid or alkali, nor of any volatile, sulphureous, or metallic matters. Waters which contain calcareous earth change the color of syrup of violets to a green; and those that contain selenites, being mixed with a solution of mercury in nitrous acid, form a turbith mineral; and, when a fixed alkali is added, they are rendered turbid, and a white sediment is precipitated. These waters do not dissolve soap well. Any water which produces these effects is a hard, earthy, or selenitic water. The waters impregnated with gases are also hard. Although the waters of the sea and saline springs be not generally enumerated amongst mineral waters, they might nevertheless be justly considered as such; for, besides earthy and selenitic matters, they also contain a large quantity of mineral salts. But mineral waters, properly so called, are those in which gas, or sulphureous, saline, or metallic substances, are discovered by chemical trials. As many of these are employed successively in medicine, they are also called medicinal waters. Mineral waters receive their peculiar principles by passing through earths containing salts, or other mineral substances, in

a state of decomposition. Some of these are valuable for the quantity of useful salts which they contain, particularly of common salt, see SALT, and others for their medicinal qualities. 'All waters,' says Dr. Thomson, 'which are distinguished from common water by a peculiar smell, taste, color, &c., and which, in consequence of these properties, cannot be applied to the purposes of domestic economy, have been called mineral waters. These occur in different parts of the earth, constituting wells, springs, or fountains; sometimes of the temperature of the soil through which they pass, sometimes warm, and in some cases even at the boiling temperature. Mineral springs,' continues this writer, 'attracted the attention of mankind in the earliest ages, and were resorted to by those who labored under diseases, and employed as a medicine. But it was not till towards the end of the seventeenth century that any attempt was made to detect the ingredients of which these waters were composed, or to discover the substances to which they owed their properties. Mr. Boyle may be considered as the first who pointed out the method of examining water. He first ascertained the existence of air in it, and pointed out a number of tests, by which conjectures might be made concerning the saline bodies which the water held in solution. In 1665 Dominici Du Clos attempted to examine the mineral waters in France. He employed almost all the re-agents recommended by Boyle, and added several of his own. In 1680 Hierne published a set of experiments on the mineral waters of Sweden. Soon after various improvements were introduced by Regis, Didier, Burlet, and Homberg; and in 1726 Boulduc pointed out a method of precipitating several of the saline contents of water by alcohol. But it was not till after the discovery of carbonic acid, by Dr. Black, that any considerable progress was made in ascertaining the composition of mineral waters. That subtile acid which is so often contained, and which serves as a solvent to many of the earths, and even metallic bodies, had thwarted all the attempts of former chemists to detect the composition of these liquids. Since the discovery of this acid the analysis of mineral waters has advanced with great rapidity, in consequence, chiefly, of the admirable dissertation on the subject published by Bergman in 1778. Since that period, much has been done by Gioanetti, Black, Klaproth, Westrumb, Fourcroy, Brezé, Kirwan, and many other eminent chemists; so that, notwithstanding the difficulty of the subject, scarcely any branch of chemistry has made greater progress, or is farther advanced, than the knowledge of mineral waters.

Dr. Ure has very ably digested the latest information on this subject: we quote his chemical analysis, as below, together with his table of the principal mineral waters. To Dr. Ryan late of Kilkenny, now of London, we are indebted for the ample list of all the known mineral waters which follows. It was first published by him in the London Medical and Physical Journal; but he has favored us with his own latest corrections of the original paper.

'The topography of the place where these waters rise is the first thing to be considered,' observes Dr. Ure. 'By examining the ooze formed by them, and the earth or stones through which they are strained and filtered, some judgment may be formed of their contents. In filtering through the earth, and meandering on its surface, they take with them particles of various kinds, which their extreme attenuation renders capable of being suspended in the fluid that serves for their vehicle. Hence we shall sometimes find in these waters, siliceous, calcareous, or argillaceous earth; and at other times, though less frequently, sulphur, magnesian earth, or, from the decomposition of carbonated iron, ochre.

The following are the ingredients that may occur in mineral waters:—

1. Air is contained in by far the greater number of mineral waters: its proportion does not exceed one twenty-eighth of the bulk of the water.

2. Oxygen gas was first detected in waters by Scheele. Its quantity is usually inconsiderable; and it is incompatible with the presence of sulphuretted hydrogen gas or iron.

3. Hydrogen gas was first detected in Buxton water by Dr. Pearson. Afterwards it was discovered in Harrowgate waters by Dr. Garnet, and in those of Leamington Priors by Mr. Lambe.

4. Sulphuretted hydrogen gas constitutes the most conspicuous ingredient in those waters, which are distinguished by the name of hepatic or sulphurous.

The only acids hitherto found in waters, except in combination with a base, are the carbonic, sulphuric, and boracic.

5. Carbonic acid was first discovered in Pyrmont water by Dr. Brownrigg. It is the most common ingredient in mineral waters, 100 cubic inches of the water generally containing from six to forty cubic inches of this acid gas. According to Westrumb, 100 cubic inches of Pyrmont water contain 187 cubic inches of it, or almost double its own bulk.

6. Sulphurous acid has been observed in several of the hot mineral waters in Italy, which are in the neighbourhood of volcanoes.

7. The boracic acid has also been observed in some lakes in Italy.

The only alkali which has been observed in mineral waters, uncombined, is soda; and the only earthy bodies are silex and lime.

8. Dr. Black detected soda in the hot mineral waters of Geyser and Rykum in Iceland; but in most other cases the soda is combined with carbonic acid.

9. Silex was first discovered in waters by Bergman. It was afterwards detected in those of Geyser and Rykum by Dr. Black, and in those of Karlsbad by Klaproth. Hassenfratz observed it in the waters of Pougues, as Brezé did in those of Pu. It has been found also in many other mineral waters.

10. Lime is said to have been found uncombined in some mineral waters; but this has not been proved in a satisfactory manner.

The only salts hitherto found in mineral waters are the following:—sulphates, nitrates, muriates, carbonates and borates; and of these the carbo-

nates and muriates occur by far most commonly, and the borates and nitrates most rarely.

11. Sulphate of soda is not uncommon, especially in those mineral waters which are distinguished by the epithet saline.

12. Sulphate of ammonia is found in mineral waters near volcanoes.

13. Sulphate of lime is exceedingly common in water. Its presence seems to have been first detected by Dr. Lister in 1682.

14. Sulphate of magnesia is almost constantly an ingredient in those mineral waters which have purgative properties. It was detected in Epsom waters in 1610, and in 1696 Dr. Grew published a treatise on it.

15. Alum is sometimes found in mineral waters, but it is exceedingly rare.

16. Sulphate of iron occurs sometimes in volcanic mineral waters, and has even been observed in other places.

17. Sulphate of copper is only found in the waters which issue from copper mines.

18. Nitre has been found in some springs in Hungary, but it is exceedingly uncommon.

19. Nitrate of lime was first detected in water by Dr. Home, of Edinburgh, in 1756. It is said to occur in some springs in the sandy deserts of Arabia.

20. Nitrate of magnesia is said to have been found in some springs.

21. Muriate of potash is uncommon; but it has lately been discovered in the mineral springs of Uhleaborg in Sweden by Julin.

22. Muriate of soda is so extremely common in mineral waters that hardly a single spring has been analysed without detecting some of it.

23. Muriate of ammonia is uncommon, but it has been found in some mineral springs in Italy and Siberia.

24. Muriate of barytes is still more uncommon, but its presence in mineral waters has been announced by Bergman.

25 and 26. Muriates of lime and magnesia are common ingredients.

27. Muriate of alumina has been observed by Dr. Withering, but it is very uncommon.

28. Muriate of manganese was mentioned by Bergman as sometimes occurring in mineral waters. It has lately been detected by Lambe in the waters of Leamington Priors, but in an extremely limited proportion.

29. The presence of carbonate of potash in mineral waters has been mentioned by several chemists; if it do occur, it must be in a very small proportion.

30. Carbonate of soda is, perhaps, one of the most common ingredients of these liquids, if we except common salt and carbonate of lime.

31. Carbonate of ammonia has been discovered in waters, but it is uncommon.

32. Carbonate of lime is found in almost all waters, and is usually held in solution by an excess of acid. It appears from the different experiments of chemists, as stated by Mr. Kirwan, and especially from those of Berthollet, that water saturated with carbonic acid is capable of holding in solution 0·002 of carbonate lime. Now water saturated with carbonic acid, at the temperature of 50°, contains very nearly 0·002 of its weight of carbonic acid. Hence it follows that carbonic acid, when present in such quantity as to saturate waters, is capable of holding its own weight of carbonate of lime in solution. Thus we see 1000 parts by weight of water, when they contain two parts of carbonic acid, are capable of dissolving two parts of carbonate of lime. When the proportion of water is increased, it is capable of holding the carbonate of lime in solution, even when the proportion of carbonic acid united with it is diminished. Thus 24,000 parts of water are capable of holding two parts of carbonate of lime in solution, even when they contain only one part of carbonic acid. The greater the proportion of water, the smaller proportion of carbonic acid is necessary to keep the lime in solution; and, when the water is increased to a certain proportion, no sensible excess of carbonic acid is necessary. It ought to be remarked also, that water, however small a quantity of carbonic acid it contains, is capable of holding carbonate of lime in solution, provided the weight of the carbonic acid present exceed that of the lime. These observations apply equally to the other earthy carbonates held in solution by mineral waters.

33. Carbonate of magnesia is also very common in mineral waters, and is almost always accompanied by carbonate of lime.

34. Carbonate of alumina is said to have been found in waters, but its presence has not been properly ascertained.

35. Carbonate of iron is by no means uncommon; indeed, it forms the most remarkable ingredient in those waters which are distinguished by the epithet of chalybeate.

36. Borax exists in some lakes in Persia and Thibet, but the nature of these waters has not been ascertained.

37 and 38. The hydrosulphurets of lime and of soda have been frequently detected in those waters which are called sulphurous, or hepatic.

Mr. Westrumb says, that all sulphurous waters contain more or less hydrosulphuret of lime. To detect this he boiled the mineral water, excluding the contact of atmospheric air, to expel the sulphuretted hydrogen gas and carbonic acid. Into the water thus boiled he poured sulphuric acid, when more sulphuretted hydrogen gas was evolved, and sulphate of lime was thrown down; fuming nitric acid, which separated from it sulphur; and oxalic acid, which expelled sulphuretted hydrogen, and formed oxalate of lime. The water evaporated in open vessels let fall sulphate of lime, and gave out sulphuretted hydrogen gas. To ascertain the quantity of sulphuretted hydrogen gas and carbonic acid, Mr. Westrumb proceeded as follows:—He introduced the sulphurous water into a matrass, till it was filled to a certain point, which he marked; fitted to it a curved tube, which terminated in a long cylinder; filled this cylinder with lime water for the one experiment, and with acetate of lead, with excess of acid, for the other; luted the apparatus; and boiled the water till no more gas was expelled. When the lime water is used, carbonate of lime is precipitated in the proportion of twenty grains to every ten cubic inches of carbonic acid gas: when the solution of acetate of lead, hydrosulphuret of lead is thrown down, in

the proportion of nineteen grains to ten cubic inches of sulphuretted hydrogen gas.

Beside these substances, certain vegetable and animal matters have been occasionally observed in mineral waters. But in most cases these are rather to be considered in the light of accidental mixtures, than of real component parts of the waters in which they occur. From this synoptical view of the different ingredients contained in mineral waters, it is evident that these substances occur in two different distinct states: 1. As being suspended in them; and 2. As being dissolved in them chiefly in the form of a salt.

The investigation of mineral waters consists, 1. In the examination of them by the senses: 2. In the examination of them by re-agents: 3. In the analysis properly so called.

The examination by the *senses* consists in observing the effect of the water as to appearance, smell, and taste. The appearance of the water, the instant in which it is pumped out of the well, as well as after it has stood for some time, affords several indications, from which we are enabled to form a judgment concerning its contents. If the water be turbid at the well, the substances are suspended only, and not dissolved; but if the water be clear and transparent at the well, and some time intervenes before it becomes turbid, the contents are dissolved by means of carbonic acid. The presence of this gas is likewise indicated by small bubbles, that rise from the bottom of the well, and burst in the air while they are making their escape, though the water at the same time perhaps has not an acid taste. This is the case, according to count Razoumowski, with respect to the tepid springs in Vallais, and the cold vitriolated chalybeate springs at Astrakhan. But the most evident proof of a spring containing carbonic acid is the generation of bubbles on the water being shaken, and their bursting with more or less noise while the air is making its escape. The sediment deposited by the water in the well is likewise to be examined: if it be yellow, it indicates the presence of iron; if black, that of iron combined with sulphur; but, chalybeate waters being seldom sulphuretted, the latter occurs very rarely. As to the color of the water itself, there are few instances where this can give any indication of its contents, as there are not many substances that color it. The odor of the water serves chiefly to discover the presence of sulphuretted hydrogen in it: such waters as contain this substance have a peculiar fetid smell, somewhat resembling rotten eggs. The taste of a spring, provided it be perfectly ascertained by repeated trials, may afford some useful indications with respect to the contents. It may be made very sensible by tasting water in which the various salts that are usually found in such waters are dissolved in various proportions. There is no certain dependence, however, to be placed on this mode of investigation; for, in many springs, the taste of sulphate of soda is disguised by that of the sea salt united with it. The water too is not only to be tasted at the spring, but after it has stood for some time. This precaution must be particularly observed with respect to such waters as are impregnated with carbonic acid; for the other substances contained in them make no impression on the tongue, till the carbonic acid has made its escape; and it is for the same reason that these waters must be evaporated in part, and then tasted again. Though the specific gravity of any water contributes but very little towards determining its contents, still it may not be entirely useless to know the specific weight of the water, the situation of the spring, and the kind of sediment deposited by it.

The examination of the water by means of *re-agents* shows what they contain, but not how much of each principle. In many instances this is as much as the enquiry demands; and it is always of use to direct the proceedings in the proper analysis. It is absolutely necessary to make the experiment with water just taken up from the spring, and afterwards with such as has been exposed for some hours to the open air; and sometimes a third essay is to be made with a portion of the water that has been boiled and afterwards filtered. If the water contain but few saline particles, it must be evaporated; as even the most sensible re-agents do not in the least affect it, if the salts, the presence of which is to be discovered by them, are diluted with too great a quantity of water. Now, it may happen, that a water shall be impregnated with a considerable number of saline particles of different kinds, though some of them may be present in too small a quantity; for which reason the water must be examined a second time, after having been boiled down to three-fourths.

The substances of which the presence is discoverable by re-agents, are:—

1. Carbonic acid. When this is not combined with any base, or not with sufficient to neutralise it, the addition of lime water will throw down a precipitate soluble with effervescence in muriatic acid. The infusion of litmus is reddened by it: but the red color gradually disappears, and may be again restored by the addition of more of the mineral water. When boiled it loses the property of reddening the infusion of litmus. According to Pfaff, the most sensible test of this acid is acetate of lead.

2. The mineral acids, when present uncombined in water, give the infusion of litmus a permanent red, even though the water has been boiled. Bergman has shown that paper stained with litmus is reddened when dipped into water containing $\frac{1}{3321}$ of sulphuric acid.

3. Water containing sulphuretted hydrogen gas is distinguished by the following properties: It exhales the peculiar odor of sulphuretted hydrogen gas. It reddens the infusion of litmus fugaciously. It blackens paper dipped into a solution of lead, and precipitates the nitrate of silver black or brown.

4. Alkalis, and alkaline and earthy carbonates, are distinguished by the following tests:—the infusion of turmeric, or paper stained with turmeric, is rendered brown by alkalis; or reddish-brown, if the quantity be minute. This change is produced when the soda in water amounts only to $\frac{1}{1817}$ part. Paper stained with Brasil wood, or the infusion of Brasil wood, is rendered blue; but this change is produced also by the alkaline and earthy carbonates. Bergman ar-

certained that water, containing [illegible]th part of carbonate of soda, reddens paper stained with Brasil wood blue. Litmus paper reddened by vinegar is restored to its original blue color. This change is produced by the alkaline and earthy carbonates also. When these changes are fugacious, we may conclude that the alkali is ammonia.

5. Fixed alkalis exist in water that occasions a precipitate with muriate of magnesia after being boiled. Volatile alkali may be distinguished by the smell; or it may be obtained in the receiver by distilling a portion of the water gently, and then it may be distinguished by the above tests.

6. Earthy and metallic carbonates are precipitated by boiling the water containing them; except carbonate of magnesia, which is precipitated but imperfectly.

7. Iron is discovered by the following tests:—The addition of tincture of gall gives water, containing iron, a purple or black color. This test indicates the presence of a very minute portion of iron. If the tincture have no effect upon the water, after boiling, though it colors it before, the iron is in the state of a carbonate. The following observations of Westrumb on the color which iron gives to galls, as modified by other bodies, deserve attention. A violet indicates an alkaline carbonate, or earthy salt. Dark purple indicates other alkaline salts. Purplish-red indicates sulphuretted hydrogen gas. Whitish, and then black, indicates sulphate of lime. Mr. Phillips has lately ascertained that, while the iron is little oxided, the presence of lime rather facilitates the application of this test; but the lime prevents the test from acting, provided the iron be considerably oxidised. The prussian alkali occasions a blue precipitate in water containing iron. If an alkali be present, the blue precipitate does not appear unless the alkali is saturated with an acid.

8. Sulphuric acid exists in waters that form a precipitate with the following solutions: muriate, nitrate, or acetate of barytes, strontia, or lime, or nitrate or acetate of lead. Of these the most powerful by far is muriate of barytes, which is capable of detecting the presence of sulphuric acid uncombined, when it does not exceed the $\frac{1}{1000000}$th part of the water. Acetate of lead is next in point of power. The muriates are more powerful than the nitrates. The calcareous salts are least powerful. All these tests are capable of indicating a much smaller proportion of uncombined sulphuric acid than when it is combined with a base. To render muriate of barytes a certain test of sulphuric acid, the following precautions must be observed:—The muriate must be diluted; the alkalis or alkaline carbonates, if the water contain any, must be previously saturated with muriatic acid; the precipitate must be insoluble in muriatic acid; if boracic acid be suspected, muriate of strontia must be tried, which is not precipitated by boracic acid. The hydrosulphurets precipitate barytic solutions, but their presence is easily discovered by the smell.

9. Muriatic acid is detected by nitrate of silver, which occasions a white precipitate or a cloud, in water containing an exceedingly minute portion of this acid. To render this test certain, the following precautions are necessary:—The alkalis or carbonates must be previously saturated with nitric acid. Sulphuric acid, if any be present, must be previously removed by means of nitrate of barytes. The precipitate must be insoluble in nitric acid. Pfaff says, that the mild nitrate of mercury is the most sensible test of muriatic acid; and that the precipitate is not soluble in an excess of any acid.

10. Boracic acid is detected by means of acetate of lead, with which it forms a precipitate insoluble in acetic acid. But, to render this test certain, the alkalis and earths must be previously saturated with acetic acid, and the sulphuric and muriatic acids removed by means of acetate of strontia and acetate of silver.

11. Barytes is detected by the insoluble white precipitate which it forms with diluted sulphuric acid.

12. Lime is detected by means of oxalic acid, which occasions a white precipitate in water containing a very minute proportion of this earth. To render this test decisive the following precautions are necessary:—The mineral acids, if any be present, must be previously saturated with an alkali. Barytes, if any be present, must be previously removed by means of sulphuric acid. Oxalic acid precipitates the magnesia but very slowly, whereas it precipitates lime instantly.

13. Magnesia and alumina. The presence of these earths is ascertained by the following tests: pure ammonia precipitates them both, and no other earth, provided the carbonic acid have been previously separated by a fixed alkali and boiling. Lime water precipitates only these two earths, provided the carbonic acid be previously removed, and the sulphuric acid also, by means of nitrate of barytes.

The alumina may be separated from the magnesia, after both have been precipitated together, either by boiling the precipitate in caustic potassa, which dissolves the alumina and leaves the magnesia; or the precipitate may be dissolved in muriatic acid, precipitated by an alkaline carbonate, dried in the temperature of 100°, and then exposed to the action of diluted muriatic acid, which dissolves the magnesia without touching the alumina.

14. Silex may be ascertained by evaporating a portion of water to dryness, and redissolving the precipitate in muriatic acid. The silex remains behind undissolved.

By these means we may detect the presence of the different substances commonly found in waters; but, as they are generally combined so as to form salts, it is necessary we should know what these combinations are. This is a more difficult task, which Mr. Kirwan teaches us to accomplish by the following methods:—1. To ascertain the presence of the different sulphates. The sulphates which occur in water are seven; but one of these, namely, sulphate of copper, is so uncommon, that it may be excluded altogether. The same remark applies to sulphate of ammonia. It is almost necessary to observe, that no sulphate need be looked for, unless both its acid and base have been previously detected in

the water. Sulphate of soda may be detected by the following method:—Free the water to be examined of all earthy sulphates, by evaporating it to one-half, and adding lime water as long as any precipitate appears. By these means the earths will all be precipitated except lime, and the only remaining earthy sulphate will be sulphate of lime, which will be separated by evaporating the liquid till it becomes concentrated, and then dropping into it a little alcohol, and, after filtration, adding a little oxalic acid. With the water, thus purified, mix solution of lime. If a precipitate appear, either immediately or on the addition of a little alcohol, it is a proof that sulphate of potassa or of soda is present Which of the two may be determined, by mixing some of the purified water with acetate of barytes. Sulphate of barytes precipitates. Filter and evaporate to dryness. Digest the residuum in alcohol. It will dissolve the alkaline acetate. Evaporate to dryness, and the dry salt will deliquesce if it be acetate of potassa, but effloresce if it be acetate of soda. Sulphate of lime may be detected by evaporating the water suspected to contain it to a few ounces. A precipitate appears, which, if it be sulphate of lime, is soluble in 500 parts of water; and the solution affords a precipitate with the muriate of barytes, oxalic acid, carbonate of magnesia, and alcohol. Alum may be detected by mixing carbonate of lime with the water suspected to contain it. If a precipitate appear, it indicates the presence of alum, or at least of sulphate of alumina; provided the water contains no muriate of barytes or metallic sulphates. The first of these salts is incompatible with alum: the second may be removed by the alkaline prussiates. When a precipitate is produced in water by muriate of lime, carbonate of lime, and muriate of magnesia, we may conclude that it contains alum or sulphate of alumina. Sulphate of magnesia may be detected by means of hydrosulphuret of strontia, which occasions an immediate precipitate with this salt, and with no other; provided the water be previously deprived of alum, if any be present, by means of carbonate of lime, and provided also that it contain no uncombined acid. Sulphate of iron is precipitated from water by alcohol, and then it may be easily recognised by its properties.

2. To ascertain the presence of the different muriates. The muriates found in waters amount to eight, or to nine if muriate of iron be included. The most common by far is muriate of soda. Muriate of soda and of potassa may be detected by the following method: Separate the sulphuric acid by alcohol and nitrate of barytes. Decompose the earthy nitrates and muriates by adding sulphuric acid. Expel the excess of muriatic and nitric acids by heat. Separate the sulphates thus formed by alcohol and barytes water. The water thus purified can contain nothing but alkaline nitrates and muriates. If it form a precipitate with acetate of silver, we may conclude that it contains muriate of soda or of potassa. To ascertain which, evaporate the liquid thus precipitated to dryness. Dissolve the acetate in alcohol, and again evaporate to dryness. The salt will deliquesce, if it be acetate of potassa; but effloresce if it be acetate of soda. Muriate of barytes may be detected by sulphuric acid, as it is the only barytic salt hitherto found in water. Muriate of lime may be detected by the following method.—Free the water from sulphate of lime and other sulphates by evaporating it to a few ounces, mixing it with alcohol, and adding last of all nitrate of barytes, as long as any precipitate appears. Filter the water; evaporate to dryness; treat the dry mass with alcohol; evaporate the alcohol to dryness; and dissolve the residuum in water. If this solution give a precipitate with acetate of silver and oxalic acid, it may contain muriate of lime. It must contain it in that case, if, after being treated with carbonate of lime, it give no precipitate with ammonia. If the liquid in the receiver give a precipitate with nitrate of silver, muriate of lime existed in the water. Muriate of magnesia may be detected by separating all the sulphuric acid by means of nitrate of barytes. Filter; evaporate to dryness; and treat the dry mass with alcohol. Evaporate the alcoholic solution to dryness, and dissolve the residuum in water. The muriate of magnesia, if the water contained any, will be found in this solution. Let us suppose, that, by the tests formerly described, the presence of muriatic acid and of magnesia, in this solution, has been ascertained. In that case, if carbonate of lime afford no precipitate, and if sulphuric acid and evaporation, together with the addition of a little alcohol, occasion no precipitate, the solution contains only muriate of magnesia. If these tests give precipitates, we must separate the lime which is present by sulphuric acid and alcohol, and distil off the acid with which it was combined. Then the magnesia is to be separated by the oxalic acid and alcohol, and the acid with which it was united is to be distilled off. If the liquid in the retort give a precipitate with nitrate of silver, the water contains muriate of magnesia. Muriate of alumina may be discovered by saturating the water, if it contain an excess of alkali, with nitric acid, and by separating the sulphuric acid by means of nitrate of barytes. If the liquid, thus purified, give a precipitate with carbonate of lime, it contains muriate of alumina. The muriate of iron or of manganese, if any be present, is also decomposed, and the iron precipitated by this salt. The precipitate may be dissolved in muriatic acid, and the alumina, iron, and manganese, if they be present, may be separated by the rules laid down below.

3. To ascertain the presence of the different nitrates.—The nitrates but seldom occur in waters; but, when they do, they may be detected by the following results:—Alkaline nitrates may be detected by freeing the water examined from sulphuric acid by means of acetate of barytes, and from muriatic acid by acetate of silver. Evaporate the filtered liquid, and treat the dry mass with alcohol; what the alcohol leaves can consist only of the alkaline nitrates and acetate of lime. Dissolve it in water. If carbonate of magnesia occasion a precipitate, lime is present. Separate the lime by means of carbonate and magnesia. Filter and evaporate to dryness, and treat the dried mass with alcohol. The alcohol now leaves only the alkaline nitrates, which may be easily recognised, and distinguished by their

respective properties. Nitrate of lime.—To detect this salt, concentrate the water, and mix it with alcohol to separate the sulphates. Filter, and distil off the alcohol; then separate the muriatic acid by acetate of silver. Filter; evaporate to dryness; and dissolve the residuum in alcohol. Evaporate to dryness, and dissolve the dry mass in water. If this last solution indicate the presence of lime by the usual tests, the water contained nitrate of lime. To detect nitrate of magnesia, the water is to be freed from sulphates and muriates exactly as described in the last paragraph. The liquid thus purified is to be evaporated to dryness, and the residuum treated with alcohol. The alcoholic solution is to be evaporated to dryness, and the dry mass dissolved in water. To this solution potash is to be added, as long as any precipitate appears. The solution, filtered, and again evaporated to dryness, is to be treated with alcohol. If it leave a residuum consisting of nitre (the only residuum which it can leave), the water contained nitrate of magnesia. Such are the methods by which the presence of the different saline contents of waters may be ascertained. The labor of analysis may be considerably shortened, by observing that the following salts are incompatible with each other, and cannot exist together in water, except in very minute proportion:

Salts.	Incompatible with.
Fixed alkaline sulphates	Nitrates of lime and magnesia, Muriates of lime and magnesia.
Sulphate of lime	Alkalis, Carbonate of magnesia, Muriate of barytes.
Alum	Alkalis, Muriate of barytes, Nitrate, muriate, carbonate of lime, Carbonate of magnesia.
Sulphate of magnesia	Alkalis, Muriate of barytes, Nitrate and muriate of lime.
Sulphate of iron	Alkalis, Muriate of barytes, Earthy carbonates.
Muriate of barytes	Sulphates, Alkaline carbonates. Earthy carbonates.
Muriate of lime	Sulphates, except of lime, Alkaline carbonates, Earthy carbonates.
Muriate of magnesia	Alkaline carbonates, Alkaline sulphates.
Nitrate of lime	Alkaline carbonates, Carbonate of magnesia and alumina, Sulphates, except of lime.

Besides the substances above described, there is sometimes found in water a quantity of bitumen combined with alkali, and in the state of soap. In such waters acids occasion a coagulation; and the coagulum collected on a filter discovers its bituminous nature by its combustibility. Water also sometimes contains extractive matter; the presence of which may be detected by means of nitrate of silver. The water suspected to contain it must be freed from sulphuric and nitric acid by means of nitrate of lead: after this, if it give a brown precipitate with nitrate of silver, we may conclude that extractive matter is present.

But it is not sufficient to know that a mineral water contains certain ingredients; it is necessary to ascertain the proportions of these, and thus we arrive at their complete analysis. 1. The different aërial fluids ought to be first separated and estimated. For this purpose, a retort should be filled two-thirds with the water, and connected with a jar full of mercury, standing over a mercurial trough. Let this water be made to boil for a quarter of an hour. The aërial fluids will pass over into the jar. When the apparatus is cool, the quantity of air expelled from the water may be determined either by bringing the mercury within and without the jar to a level; or, if this cannot be done, by reducing the air to the proper density by calculation. The air of the retort ought to be carefully subtracted, and the jar should be divided into cubic inches and tenths. The only gaseous bodies contained in water are common air, oxygen gas, nitrogen gas, carbonic acid, sulphureted hydrogen gas, and sulphurous acid. The last two never exist in water together. The presence of either of them must be ascertained previously by the application of the proper tests. If sulphureted hydrogen gas be present, it will be mixed with the air contained in the glass jar, and must be separated before this air be examined. For this purpose the jar must be removed into a tub of warm water, and nitric acid introduced, which will absorb the sulphureted hydrogen. The residuum is then to be again put into a mercurial jar, and examined. If the water contain sulphurous acid, this previous step is not necessary. Introduce into the air a solution of pure potash, and agitate the whole gently. The carbonic acid and sulphurous acid gas will be absorbed, and leave the other gases. The bulk of this residuum, subtracted from the bulk of the whole, will give the bulk of the carbonic acid and sulphurous acid absorbed. Evaporate the potash slowly, almost to dryness, and leave it exposed to the atmosphere. Sulphate of potash will be formed, which may be separated by dissolving the carbonate of potash by means of diluted muriatic acid, and filtering the solution: 100 grains of sulphate of potash indicate 36·4 grains of sulphurous acid, or 53·66 cubic inches of that acid in the state of gas. The bulk of sulphurous acid gas ascertained by this method, subtracted from the bulk of the gas absorbed by the potash, gives the bulk of the carbonic acid gas. Now 100 cubic inches of carbonic acid, at the temperature of 60° and barometer thirty inches, weigh 46·6 grains. Hence it is easy to ascertain its weight. The gas remaining may be examined by the common eudiometrical processes. When a water contains sulphureted hydrogen gas, the bulk of this gas is to be ascertained in the following manner: fill three-fourths of a jar with the water to be examined, and invert it in a water trough, and introduce a little nitrous gas. This gas, mixing with the air in the upper part of the

jar, will form nitrous acid, which will render the water turbid, by decomposing the sulphureted hydrogen, and precipitating sulphur. Continue to add nitrous gas at intervals as long as red fumes appear, then turn up the jar and blow out the air. If the hepatic smell continue, repeat this process. The sulphur precipitated indicates the proportion of hepatic gas in the water; one grain of sulphur indicating the presence o nearly three cubic inches of this gas.

2. After having estimated the gaseous bodies, the next step is to ascertain the proportion of the earthy carbonates. For this purpose it is necessary to deprive the water of its sulphureted hydrogen, if it contain any. This may be done, either by exposing it to the air for a considerable time, or treating it with litharge. A sufficient quantity of the water, thus purified if necessary, is to be boiled for a quarter of an hour, and filtered when cool. The earthy carbonates remain on the filter. The precipitate thus obtained may be carbonate of lime, of magnesia, of iron, of alumina, or even sulphate of lime. Let us suppose all of these substances to be present together. Treat the mixture with diluted muriatic acid, which will dissolve the whole except the alumina and sulphate of lime. Dry this residuum in a red heat, and note the weight. Then boil it in carbonate of soda, saturate the soda with muriatic acid, and boil the mixture for half an hour. Carbonate of lime and alumina precipitate. Dry this precipitate, and treat it with acetic acid. The lime will be dissolved, and the alumina will remain. Dry it and weigh it. Its weight, subtracted from the original weight, gives the proportion of sulphate of lime. The muriatic solution contains lime, magnesia, and iron. Add ammonia as long as reddish precipitate appears. The iron and part of the magnesia are thus separated. Dry the precipitate, and expose it to the air for some time in a heat of 200°; then treat it with acetic acid to dissolve the magnesia; which solution is to be added to the muriatic solution. The iron is to be re-dissolved in muriatic acid, precipitated by an alkaline carbonate, dried and weighed. Add sulphuric acid to the muriatic solution as long as any precipitate appears; then heat the solution and concentrate. Heat the sulphate of lime thus obtained to redness, and weigh it: 100 grains of it are equivalent to 74·7 of carbonate of lime dried. Precipitate the magnesia by means of carbonate of soda. Dry it and weigh it. But, as part remains in solution, evaporate to dryness, and wash the residuum with a sufficient quantity of distilled water, to dissolve the muriate of soda and sulphate of lime, if any be still present. What remains behind is carbonate of magnesia. Weigh it, and add its weight to the former. The sulphate of lime, if any, must also be separated and weighed.

3. We have next to ascertain the proportion of mineral acids or alkalis, if any be present uncombined. The acids which may be present, omitting the gaseous, are the sulphuric, muriatic, and boracic. The proportion of sulphuric acid is easily determined. Saturate it with barytes water, and ignite the precipitate. 100 grains of sulphate of barytes, thus formed, indicate 34·0 of real sulphuric acid. Saturate the muriatic acid with barytes water, and then precipitate the barytes by sulphuric acid: 100 parts of the ignited precipitate are equivalent to 23·73 grains of real muriatic acid. Precipitate the boracic acid by means of acetate of lead. Decompose the borate of lead by boiling it in sulphuric acid. Evaporate to dryness. Dissolve the boracic acid in alcohol, and evaporate the solution; the acid left behind may be weighed. To estimate the proportion of alkaline carbonate present in a water containing it, saturate it with sulphuric acid, and note the weight of real acid necessary. Now 100 grains of real sulphuric acid saturate 120·0 potash, and 80·0 soda.

4. The alkaline sulphates may be estimated by precipitating their acid by means of nitrate of barytes, having previously freed the water from all other sulphates; for 14·75 grains of ignited sulphate of barytes indicate 9·0 grains of dried sulphate of soda; while 14·75 sulphate of barytes indicate eleven of dry sulphate of potash. Sulphate of lime is easily estimated by evaporating the liquid containing it to a few ounces (having previously saturated the earthy carbonates with nitric acid), and precipitating the sulphate of lime by means of weak alcohol. It may then be dried and weighed. The quantity of alum may be estimated by precipitating the alumina by carbonate of lime or of magnesia (if no lime be present in the liquid). Eleven grains of the alumina, heated to incandescence, indicate 100 of crystallised alum, or fifty-five of dried salt. Sulphate of magnesia may be estimated, provided no other sulphate be present, by precipitating the acid by means of a barytic salt, as 14·75 parts of ignited sulphate of barytes indicate 7·46 of sulphate of magnesia. If sulphate of lime, and no other sulphate, accompany it, this may be decomposed, and the lime precipitated by carbonate of magnesia. The weight of the lime, thus obtained, enables us to ascertain the quantity of sulphate of lime contained in the water. The whole of the sulphuric acid is then to be precipitated by barytes. This gives the quantity of sulphuric acid; and, subtracting the portion which belongs to the sulphate of lime, there remains that which was combined with the magnesia, from which the sulphate of magnesia may be easily estimated. If sulphate of soda be present, no earthy nitrate or muriate can exist. Therefore, if no other earthy sulphate be present, the magnesia may be precipitated by soda, dried and weighed; 2·46 grains of which indicate 7·46 grains of dried sulphate of magnesia. The same process succeeds when sulphate of lime accompanies these two sulphates; only in this case the precipitate, which consists both of lime and magnesia, is to be dissolved in sulphuric acid evaporated to dryness, and treated with twice its weight of cold water, which dissolves the sulphate of magnesia, and leaves the other salt. Let the sulphate of magnesia be evaporated to dryness, exposed to a heat of 400°, and weighed. The same process succeeds, if alum be present instead of sulphate of lime. The precipitate in this case, previously dried, is to be treated with acetic acid, which dissolves the magnesia, and leaves the alumina. The magnesia

may be again precipitated, dried, and weighed. If sulphate of iron be present, it may be separated by exposing the water to the air for some days, and mixing with it a portion of alumina. Both the oxide of iron and the sulphate of alumina, thus formed, precipitate in the state of an insoluble powder. The sulphate of magnesia may then be estimated by the rules above given. Sulphate of iron may be estimated by precipitating the iron by means of prussic alkali, having previously determined the weight of the precipitate produced by the prussiate in a solution of a given weight of sulphate of iron in water. If muriate of iron be also present, which is a very rare case, it may be separated by evaporating the water to dryness, and treating the residuum with alcohol, which dissolves the muriate, and leaves the sulphate.

5. If muriate of potash, or of soda, without any other salt, exist in water, we have only to decompose them by nitrate of silver, and dry the precipitate; for 18·4 of muriate of silver indicate 9·5 of muriate of potash; and 18·4 of muriate of silver indicate 7·5 of common salt. The same process is to be followed if the alkaline carbonates be present; only these carbonates must be previously saturated with sulphuric acid; and we must precipitate the muriatic acid by means of sulphate of silver instead of nitrate. The presence of sulphate of soda does not injure the success of this process. If muriate of ammonia accompany either of the fixed alkaline sulphates, without the presence of any other salt, decompose the sal ammoniac by barytes water, expel the ammonia by boiling, precipitate the barytes by diluted sulphuric acid, and saturate the muriatic acid with soda. The sulphate of barytes, thus precipitated, indicates the quantity of muriate of ammonia, 14·75 grains of sulphate indicating 6·75 grains of this salt. If any sulphates be present in the solution they ought to be previously separated. If common salt be accompanied by muriate of lime, muriate of magnesia, muriate of alumina, or muriate of iron, or by all these together, without any other salt, the earths may be precipitated by barytes water, and redissolved in muriatic acid. They are then to be separated from each other by the rules formerly laid down; and their weight, being determined, indicates the quantity of every particular earthy muriate contained in the water. For fifty grains of lime indicate 100 of dried muriate of lime; thirty grains of magnesia indicate 100 of the muriate of that earth; and 21·8 grains of alumina indicate 100 of the muriate of alumina. The barytes is to be separated from the solution by sulphuric acid, and the muriatic acid expelled by heat, or saturated with soda; the common salt may then be ascertained by evaporation, subtracting in the last case the proportion of common salt indicated by the known quantity of muriatic acid from which the earths had been separated. When sulphates and muriates exist together they ought to be separated either by precipitating the sulphates by means of alcohol, or by evaporating the whole to dryness, and dissolving the earthy muriates in alcohol. The salts thus separated may be estimated by the rules already laid down. When alkaline and earthy muriates and sulphate of lime occur together, the last is to be decomposed by means of muriate of barytes. The precipitate ascertains the weight of sulphate of lime contained in the water. The estimation is then to be conducted, as when nothing but muriates are present; only from the muriate of lime that proportion of muriate must be deducted which is known to have been formed by the addition of the muriate of barytes. When muriates of soda, magnesia, and alumina, are present together with sulphates of lime and magnesia, the water to be examined ought to be divided into two equal portions. To the one portion add carbonate of magnesia, till the whole of the lime and alumina be precipitated. Ascertain the quantity of lime which gives the proportion of sulphate of lime. Precipitate the sulphuric acid by muriate of barytes. This gives the quantity contained in the sulphate of magnesia and sulphate of lime: subtracting this last portion, we have the quantity of sulphate of magnesia. From the second portion of water precipitate all the magnesia and alumina by means of lime water. The weignt of these earths enables us to ascertain the weight of muriate of magnesia and of alumina contained in the water, subtracting that part of the magnesia which existed in the state of sulphate, as indicated by the examination of the first portion of water. After this estimation, precipitate the sulphuric acid by barytes water, and the lime by carbonic acid. The liquid, evaporated to dryness, leaves the common salt.

6. It now only remains to explain the method of ascertaining the proportion of the nitrates which may exist in waters. When nitrate accompanies sulphates and muriates, without any other nitrates, the sulphates are to be decomposed by acetate of barytes, and the muriates by acetate of silver. The water, after filtration, is to be evaporated to dryness, and the residuum treated with alcohol, which dissolves the acetates, and leaves the nitre, the quantity of which may be easily calculated. If an alkali be present it ought to be previously saturated with sulphuric or muriatic acid. If nitre, common salt, nitrate of lime, and muriate of lime or magnesia, be present together, the water ought to be evaporated to dryness, and the dry mass treated with alcohol, which takes up the earthy salts. From the residuum, redissolved in water, the nitre may be separated, and calculated as in the last case. The alcoholic solution is to be evaporated to dryness, and the residuum redissolved in water. Let us suppose it to contain muriate of magnesia, nitrate of lime, and muriate of lime. Precipitate the muriatic acid by nitrate of silver, which gives the proportion of muriate of magnesia and of lime. Separate the magnesia by means of carbonate of lime, and note its quantity. This gives the quantity of muriate of magnesia; and, subtracting the quantity of muriatic acid contained in that salt from the whole acid indicated by the precipitate of silver, we have the proportion of muriate of lime. Lastly, saturate the lime added to precipitate the magnesia with nitric acid. Then precipitate the whole of the lime by sulphuric acid; and subtracting from the whole of the sulphate thus formed that portion formed by

the carbonate of lime added, and by the lime contained in the muriate, the residuum gives us the lime contained in the original nitrate; and thirty-five grains of lime form 102·5 of dry nitrate of lime.

In the year 1807 Dr. Marcet advanced some new ideas on the art of analysing mineral waters, in an admirable paper on the water of the Dead Sea, inserted in the Philosophical Transactions. 'It is satisfactory to observe,' says this excellent chemist, 'that Dr. Murray adopted, several years afterwards, a mode of proceeding precisely similar, and indeed that he proposed, in a subsequent paper, a general formula for the analysis of mineral waters, in which this method is pointed out, as likely to lead to the most accurate results. And this coincidence is the more remarkable, as it would appear, from Dr. Murray not mentioning my labors, that they had not at that time come to his knowledge.'—*Philosophical Transactions*, 1819, part ii.

We prefix, after Dr. Ure, the results of the recent analysis by M. Berzelius of the waters of Carlsbad. They are very extraordinary, and he has found many substances not hitherto suspected to exist in them.

Sulphate of soda	2·58714
Carbonate of soda	1·25200
Muriate of soda	1·04893
Carbonate of lime	0·31219
Fluate of lime	0·00331
Phosphate of lime	0·00019
Carbonate of strontites	0·00097
Carbonate of magnesia	0·18221
Phosphate of alumina	0·00034
Carbonate of iron	0·00424
Carbonate of manganese	a trace
Silica	0·07504
	5·46656

Ann. de Chim. et Phys. xxi. 248.

The following table exhibits the compositions of the principal mineral waters as well as that of the sea. The reader will find, in the Philosophical Transactions for 1819, a very valuable dissertation on sea-water, by Dr. Marcet, of which a good abstract is given in the second volume of the Edinburgh Philosophical Journal. This philosopher shows that in Baffin's Bay, the Mediterranean Sea, and the tropical Seas, the temperature of the sea diminishes with the depth, according to the observations of Phipps, Ross, Parry, Sabine, Saussure, Ellis, and Peron; but that in the Arctic or Greenland Seas the temperature of the sea increases with the depth. This singular result was first obtained by Mr. Scoresby, in a series of well conducted experiments, and has been confirmed by the later observations of lieutenants Franklin and Beechy, and Mr. Fisher

TABLE of the Composition of the most celebrated MINERAL WATERS.

	Names of the Springs.	Grains of Water.	Cubic Inches of Gases. Oxygen.	Carbonic Acid.	Sulph. hydrogen.	Azote.	Carbonates of Soda. gr.	Lime. gr.	Magnesia. gr.	Iron. gr.	Sulphates of Soda. gr.	Lime. gr.	Magnesia. gr.	Iron. gr.	Muriates of Soda. gr.	Lime gr.	Magnesia. gr.	Potash. gr.	Silica. gr.	Alumina. gr.	Resins. gr.	Temperature.
Acidulous.	Seltzer[1]	8949	43·5	13·068			5·22	78·3	6·32			8·38			13·74							cold
	Pyrmont[1]	8950		19·6				4·3	9·8	0·70			5·44		1·7							cold
	Spa[1]	8933		9·8			1·85	1·85	4·35	0·70					0·21							cold
	Carlsbad[2]	25320		50·0			38·5	12·5		0·1¼	66·75				32·5				2·25			165°
	Kilburn[10]	138240		84·0	36·0			2·4	1·25	0·3¼	18·2	13·0	91·0		6·0	0·6	2·8				6·0	cold
Sulphurous.	Harrowgate[14]	103643		8·0	19·0	7·0		18·5	5·5				0·5		615·5	3·0	9·1					cold
	Moffat[14]	103643		1·0	10·0	4·0									3·6							cold
	Aix-la-Chapelle[3]	8940			13·06			15·25	5·89						6·21							143°
	Enghien[5]	92160		18·5	7·0			21·4	1·35			33·3	5·8		2·4		8·0					cold
Saline.	Sedlitz	58309		8·0				6·7	21·0			41·1	1444				36·5					cold
	Cheltenham[6]	103643		30·3	3·0	12·0			12·5	5·0	48·0	40·			5·0		12·5					cold
	Plombieres[20]	14600					36·	0·4			1·0				2·0							cold
	Dunblane[16] sp. gr. 1·00475	7291						0·5		0·17	3·7				21·	20·8						cold
	Pitcaithly[16]	7291		1·				0·5			0·9				12·7	20·2						cold
Chalybeate.	Tunbridge[3]	103643	1·4	10·6		4·0				1·0		1·25			0·5		2·25					cold
	Brighton[4]	58309		18·0								32·7		11·2	12·2		6·0		1·12			cold
	Toplitz[7]	22540					13·5	16·5		32·5					61·3	28·5				15·1		cold
Calcareous, nearly pure.	Bath[8]	15360		2·4				1·6		0·004	3·0	18·0			6·6				0·4			114°
	Buxton[9]	58309				2·0		10·5				2·5			1·5							82°
	Bristol[11]	58309		30·3				13·5			11·2	11·7			4·0		7·25					74°
	Matlock	58309										trace										66°
	Malvern[15]	58309					5·33	1·6	0·92	0·625	2·896				1·55							cold
	Dead Sea[17] sp. gr. 1·211	100										·054			10·676	3·8	10·1					
	Ditto[18] sp. gr. 1·245														7·8	10·6	24·2					
	Ditto[19] sp. gr. 1·2283														6·95	4·0	15·31					
	Sea water, Forth[16]	7291									25·6				159·3	5 7	35·5	trace †				

[1] Bergman. [2] Klaproth. [3] Babington. [4] Marcet. [5] Fourcroy. [6] Fothergill. [7] John. [8] Phillips. [9] Pearson. [10] Schmesser [11] Carrick. [14] Garnet. [15] Dr. Philip. [16] Dr. Murray. [17] Dr. Marcet. [18] Klaproth [19] M. Gay Lussac. † Dr. Wollaston. [20] Vauquelin.

An Alphabetical List of the Mineral Waters of Europe and their Qualities by Dr. Ryan.

Abcourt, St. Germain's, France, contains carbonate of iron and soda; is diuretic and aperient, and used in dropsy, jaundice, visceral obstructions, and eruptions.
Aberbrothick, Forfar, Scotland; a carbonated chalybeate, used in dyspepsia.
Acton, Middlesex, contains sulphate of magnesia and muriate of soda.
Aghaloo, Tyrone, contains sulphur, carbonate of soda, and aperient salts; used in scrofula.
Aix, in Provence; used in piles, diseases of the kidney and bladder, in fluor albus, excessive menstruation, and gonorrhœa; is somewhat similar to Plombieres.
Aix-la-Chapelle, Germany, contains carbonate of lime, muriate and carbonate of soda, and sulphur; is diaphoretic and purgative, and has been used in heartburn, asthma, ague, excessive menstruation; externally, in rheumatism, palsy, tremors, contractions, tumors, and cutaneous diseases.
Albermarle, or Aumale, Rouen, contains carbonate of iron.
Alford, or Awford, Somersetshire, is saline and strongly purgative.
Alvenan, Switzerland, is famous for bathing.
Annfield, Burrisoleigh, Tipperary, an excellent simple chalybeate.
Annaduff, Leitrim, is a sulphurous water.
Antrim, Ireland, contains muriate of soda, carbonate of lime, and bittern; has been used in dropsy, scurvy, jaundice, and visceral obstructions.
Ashwood, Fermanagh, is a saline and sulphurous water.
Ashton, Wiltshire, is a carbonated chalybeate water.
Askeron, Yorkshire, is a saline and sulphurous water.
Athlone, Roscommon, is a simple, weak chalybeate.
Athimonus, Leitrim, strongly sulphurous; much used in scrofula.
Austria is said to contain mineral waters, at Sellrain, Merain, Sexton, Prax, Agums, Brutz, Rabi, Pei, Stiria, Carinthia, and Carniola.
Baden, Germany, is a hot sulphurous water, resembling Aix-la-Chapelle.
Bagnigge, Middlesex, contains sulphate and muriate of magnesia; is aperient.
Baia, Italy, is a strong sulphurous water.
Balemore, Worcestershire, contains carbonate of iron; is strongly tonic.
Balaruc, near Montpelier, contains purging salts; is aperient and diuretic, has been employed in jaundice, palsy, scrofula, in diseases of the kidney and bladder, and externally in cutaneous affections.
Ballycastle, Antrim, is a chalybeate and sulphurous water; its effects are like Balemore.
Ballynahinch, Down, contains iron, carbonic acid, and sulphur; has been praised in scorbutic and dyspeptic cases. There is also a pure chalybeate in its vicinity.
Ballyspellan, Johnstown, Kilkenny, contains iron, carbonic acid, and muriate of soda; has been greatly esteemed in dyspepsia, chlorosis, lowness of spirits, and visceral obstructions.
Bagniers, Upper Pyrenees, said to be similar to Aix-la-Chapelle.
Bagnols, Guard, France, is a tepid, sulphurous water, and used in phthisis, affections of kidney, psora, palsy, and rickets.
Bandola, Italy, contains carbonic acid, iron, soda, and sulphur; is aperient, diaphoretic, and diuretic.
Bandon, Cork, is a simple chalybeate water.
Barèges, France, on the Pyrenees, contains muriate and carbonate of soda, lime, and sulphur; its temperature 115°; it is said to be similar to Bath. It has been used in nervous, œdematous, and cutaneous affections; in visceral obstructions, in rheumatism, chlorosis, and consumption; is aperient and diuretic.
Barnet, Hertfordshire, contains sulphate of magnesia and carbonate of lime.
Barrowdale, Cumberland, contains muriate of soda in great quantity, and carbonate of lime.
Bath, Somersetshire, contains carbonic acid, azotic gas, sulphate and muriate of soda, siliceous earth, selenite, carbonate of lime, and oxide of iron; temperature, 112° to 116°.—Saunders on Mineral Waters. It is diuretic, sudorific, and aperient; but, if drunk in small quantities at the commencement, it induces constipation and stupor. It has been employed in diseases of the stomach, liver, and bowels; in gout, rheumatism, and partial paralysis; in chlorosis, and, according to the excellent Treatise of Dr. Barlow on Bath Waters, in chronic eruptions.
Bologne, near Calais, contains carbonate of iron.
Bigova, Russia, a similar water to the last named.
Bonnes, Lower Pyrenees, similar to Bareges; temperature, 102°.
Bourbon l'Archambaud, near Moulins, is saline, and has been used in diseases of the liver, jaundice, bowel affections, and apoplexy.
Bourbonne Lancy, is aperient, diuretic, and emmenagogue; has been used in cachexia, diarrhœa, fluor albus, œdema, and asthma. Externally, in palsy, tremors, rheumatism, and cutaneous affections.
Bourbonne, France, is a warm, saline, and sulphurous water.
Borset, near Aix-la-Chapelle, a warm, alkaline, and sulphurous water; 132°.
Brentwood, Essex, contains sulphate of magnesia and lime; purgative
Brighton, a chalybeate.
Bristol, Somersetshire, contains lime, muriate of soda, sulphate of magnesia, and selenite; temperature, 74°. It has been considered as a specific in consumption; allays hectic; is used in bilious diarrhœa, dysentery, diabetes, calculous and cancerous disorders, and fluor albus.
Bromley, Kent, a carbonated chalybeate; is diuretic and corroborative.
Broughton, Yorkshire, said to be similar to Harrowgate.
Brownstown, Kilkenny, contains carbonate of iron, lime, magnesia, and muriate of soda. It has been used with advantage in stomach, liver

or other visceral diseases; in calculous and uterine disorders; and against tœnia lumbricus.

Buxton, Derbyshire, contains muriate and carbonate of soda, and lime; temperature, 82°; is praised in gout and rheumatism, and in diseases where bathing is useful.

Buda, in Hungary, is famed for its excellent baths.

Buzot, Spain, is a warm chalybeate water.

Caldas, also famed for baths, Portugal, contains sulphur, gas, argilla, and muriate of soda; it is famed for chronic rheumatism and dyspepsia.

Calabria, Italy, a saline water, containing sulphate of soda.

Cape Clear, a saline, purgative water.

Carlsbad, Germany, a warm, alkaline, aperient water.

Caroline baths, Bohemia, contain iron, carbonic acid, carbonate of lime, muriate and carbonate of soda, carbonate and sulphate of magnesia; are used in scrofula, dyspepsia, &c., in baths.

Carrickfergus, Antrim, from its blue color, said to contain copper.

Carrickmore, Cavan, contains carbonate of soda; is aperient.

Cartmel, Lancashire, contains muriate of soda and Epsom salts.

Castlecomer, Kilkenny, situated in the beautiful and classic demesne of the dowager countess of Ormond and Ossory. It was analysed by the late professor Higgins, of the Royal Dublin Society, and was found to contain iron, carbonic acid, and muriate of soda; results which I observed from my own experiments; and Drs. Wade, Garnet, and Ryan, thought it one of the best chalybeates in Ireland.

Castleconnel, Limerick, contains carbonate of iron; is said to resemble the German spa, and has been very much frequented for many years.

Castleleod, Rosshire, Scotland, contains carbonate of soda and sulphur.

Castlemain, Kerry, contains iron, sulphur, and carbonic acid.

Cawley, Derbyshire, contains sulphate of magnesia and sulphate of lime.

Cawthorp, Lincolnshire, contains iron, carbonic acid, and carbonate of soda; is aperient and antacid.

Cavan Spa is a chalybeate.

Cautères, Upper Pyrenees, near Bagnieres, is a warm water; temperature 102° to 120°. Is much praised in acidity of the stomach, asthma, consumption, suppression of mènses, and cutaneous affections.

Chadlington, Oxfordshire, contains carbonate and muriate of soda, and sulphur; is an aperient.

Chaude Fontaine, Germany, same as Aix-la-Chapelle.

Cheltenham, Gloucestershire, contains calcareous earth, iron, sulphate of magnesia, and muriate of soda; is aperient and tonic, and much used in dyspepsia, bilious complaints, scurvy, and gravel.

Chippenham, Wiltshire, contains carbonate of iron.

Clashmore, Waterford, said to contain sulphate of iron, by Elliot.

Cleves, Germany, similar to Pyrmont.

Clifton, near Bristol; to which it is similar.

Clonmell, Tipperary, a sulphurous water, much praised for scrofula.

Cobham, Surrey, contains iron and purging salt.

Codsalwood, Staffordshire, resembles Askeron water.

Colchester, Essex, contains sulphate of magnesia and carbonate of lime.

Coalcullen, Kilkenny, is a carbonated chalybeate.

Cork county contains many mineral waters, not given in this account, of minor note. (See my Treatise on the Mineral Waters of Ireland, 1824, Longman).

Corstophine, Mid Lothian, contains sulphur and sulphate of magnesia.

Corville, Roscrea, Tipperary, a simple chalybeate water.

Coventry, Warwickshire, contains carbonate of iron and purging salt.

Cransac, Aveiron, contains carbonate of iron and sulphur.

Crosstown, Waterford, contains sulphate of iron; is diuretic and purgative.

Daswild Bad, Germany, contains carbonate of iron and saline matter; in visceral diseases.

Dax, near Bayonne, similar to Aix-la-Chapelle; discharges 543 cubic feet of water in fifteen minutes; is exhibited in affections of the kidney, in asthma, palsy, and rheumatism, in baths.

Deddington, Oxford, contains iron, sulphur, carbonated earth, muriate and carbonate of soda; greatly praised in cutaneous diseases.

Derby, Derbyshire, contains carbonate of iron.

Derryinch, Fermanagh, contains sulphur and carbonate of soda.

Derrindaff, Cavan, contains sulphur and purging salt.

Derrylester, Cavan, a strongly sulphurous water.

Digne, Lower Alps, warm, saline, and sulphurous; aperient and diuretic. Is used in dyspepsia, scrofula, asthma, visceral obstructions, and eruptions.

Dog and Duck, near London, contains sulphate of magnesia and muriate of soda; it is said to be a cooling purgative.

Doneraile, Cork, a chalybeate.

Drigwell, Cumberland, similar to Deddington.

Driburgin, Westphalia, a saline chalybeate.

Dronisnamullock, Leitrim, a very strong sulphurous water.

Droppingwell, Yorkshire, contains carbonated earth; is astringent and tonic.

Drumasnave, Leitrim, one of the strongest sulphurous waters in Ireland.

Dudley, Worcestershire, sulphurous and chalybeate.

Dublin salt springs, Francis Street, and Hanover Lane waters.

Dulwich, Kent, contains muriate of soda and sulphate of magnesia.

Dunnard, Dublin, a simple carbonated chalybeate.

Dunse, Scotland, contains iron, muriate of soda, and bittern.

Durham contains sulphur and muriate of soda. A saline spring there.

Egra, Bohemia, said to be similar to Cheltenham.
Ems, Germany, famed for sulphurous baths.
Emsem, Germany, properties not described.
Enghien, Netherlands, contains sulphureted hydrogen.
Epsom, Surrey, contains muriate and sulphate of magnesia.
Fairburn, Rosshire, Scotland, contains sulphur and sulphate of soda.
Fahara, Switzerland, famed for baths.
Felstead, Essex, similar to Islington.
Filah, Yorkshire, is powerfully diuretic and aperient.
Forgès, Rouen, contains carbonate of iron.
Frankfort, Germany, is similar to Harrowgate.
Gainsborough, Lincolnshire, contains sulphur, iron, and Epsom salts.
Geyser, Iceland, contains pure soda.
Galway is similar to Tunbridge.
Garryhill, Carlow, a chalybeate.
Glastonbury, Somersetshire, similar to Clifton.
Glendy, Kincardine, Scotland, similar to Peterhead.
Granshaw, Ireland, similar to the German Spa.
Gran, Hungary, not described.
Grossal, Germany, a calcareous water.
Haigh, Lancashire, contains carbonate and sulphate of iron; is emetic.
Hampstead, Middlesex, similar to last-named.
Hanbridge, Lancashire, similar to Scarborough; is less aperient.
Hanlays, Shropshire, contains purging salts, is aperient.
Harrowgate, Yorkshire, discovered 1571, by captain Slingsby; found to contain sulphur, muriate of soda, and purging salt. It is alterative and purgative; destroys worms; is praised in scurvy, scrofula, palsy, and chiefly in cutaneous diseases.
Hartfell, Scotland, contains sulphate of iron; is astringent and tonic, and used in all internal hæmorrhages.
Hartlepool, Durham, contains sulphur, iron, and carbonic acid.
Healinglake, Cavan, cures scrofula, and is attested by many respectable persons.
Holt, Wiltshire, is mildly purgative, and used in ulcers and eruptions.
Jerpoint Abbey spa, Kilkenny, is a strong sulphurous water.
Italy contains many sulphurous and warm springs, of little note.
Joseph's-well, Surrey, contains a large portion of sulphate of magnesia.
Johnstown, see *Ballyspellan.*
John's-well, Kilkenny, same as Johnstown; not so strong.
Ilmington, Warwickshire, contains carbonate of iron and soda.
Inglewhite, Lancashire, a sulphurous chalybeate.
Islington, near London, contains carbonate of iron; is tonic and diuretic.
Kanturk, Cork, contains iron and sulphur; used in scrofula and eruptions.
Kedlestone, Derbyshire, is similar to Harrowgate.
Kensington, near London, is similar to Acton.
Kilbrew, Meath, similar to Shadwell.
Kilburn, England, a sulphurous and saline water.
Kilcoran, Clare, a chalybeate.
Kilagee, Down, a chalybeate.
Killashen, Fermanagh, a sulphurous water.
Kileshan, Queen's County, a weak chalybeate.
Kilkenny college and canal spas, sulphurous and chalybeate.
Kilroot, Antrim, is similar to Barrowdale.
Kinalton, Nottinghamshire, a saline aperient water.
Kilmainham, Dublin, a sulphurous chalybeate.
Kincardine, Scotland, similar to Peterhead.
Kingscliff, Northamptonshire, similar to Cheltenham.
Kirkby, Westmoreland, a saline chalybeate.
Knaresborough, see *Droppingwell.*
Klintschyselo, Russia, warm springs at.—*Clarke's Russia.*
Knowsley, Lancashire, same as Scarborough.
Kuka, Bohemia, contains carbonate of soda; is diaphoretic and sialagogue.
Lancaster, similar to Tunbridge.
Langeac, Upper Loire, a cold acidulous water.
Latham, Lancashire, similar to Tunbridge.
Leuck, Switzerland, not described chemically.
Llanndridad, Wales, a sulphurous chalybeate.
Lucca, Italy, a warm spring.
Llangybi, Wales, properties unknown.
Lisbeak, Fermanagh, strongly sulphurous.
Lemington, Warwickshire, contains muriate of soda and carbonate of lime; is strongly aperient, and much frequented.
Leez, Essex, same as Islington.
Listerlin, Kilkenny, a chalybeate.
Loansbury, Yorkshire, is sulphurous and aperient, used in eruptions.
Lough Neagh, Down, said to cure running ulcers.
Madrid, a mineral water there contains sulphate of soda very largely.
Mallow, Cork, is similar to Bristol; discovered 1689, by Dr. Rogers, of Cork, one of whose patients drank of the water accidentally. It discharges twenty gallons in the minute; is clear and limpid when drawn from the fountain, with a vapor arising from it. I have seen the most decided good effects from this water in consumptive habits, even in cases which were considered hopeless. It is used in the same manner as the Bristol water.
Maherabeg, Kerry, is a saline aperient water.
Malvern, Worcestershire, contains carbonic acid, lime, and magnesia, united with carbonic and muriatic acids; is tonic and diuretic. Is used in muco-purulent affections of the bladder, in hectic and consumptive cases; in bilious and female diseases; in scrofulous and chronic eruptions.
Markshall, Essex, same as Islington.
Maudley, Lancashire, sulphurous and saline.
Matlock, Derbyshire, similar to Bristol; temperature 66°.
Micham, Fermanagh, a sulphurous water.
Miers, France, aperient and diuretic.
Millar's Spa, Lancashire, same as Tunbridge.
Miltown Malbay, Clare, a chalybeate water.
Moffat, Annandale, Scotland, contains sulphur, muriate of soda, and an earth. Is alterative, diuretic, and purgative; is used as a bath.
Mont d'Or, France, same as Aix-la-Chapelle.
Mont Pallas, Cavan, a chalybeate water.

Montmorency, Paris, a sulphurous spring.
Monfrin, Nimes, France, is aperient and diuretic.
Mosshouse, Lancashire, same as Islington.
Moreton, Shropshire, similar to Holt.
Motte, near Grenoble, is a warm sulphurous water.
Neville Holt, Leicestershire, contains carbonated earth and Epsom salts.
Naphtha, Russia, a chalybeate.
New Cartmel, Lancashire, saline and aperient.
Naples, a sulphurous and chalybeate water, near St. Luke's church.
Newnham Regis, Warwickshire, similar to Scarborough.
Newtondale, Yorkshire, contains carbonate of lime and magnesia.
Newtown Stewart, Tyrone, is similar to Tunbridge.
Nezdenice, Germany, carbonate of iron and soda; diuretic and tonic.
Nobber, Meath, is similar to Hartfell.
Nocaria, Italy, famed for baths.
Normandy, Yorkshire, is similar to Askeron water.
Nottingham, Dorsetshire, sulphurous and saline: used in eruptions.
Oakfield, Cavan, a chalybeate.
O'Brien's Bridge, Clare, a strong sulphurous water.
Oersten, Denmark, little frequented.
Orston, Nottingham, contains carbonic acid in excess, iron, and sulphate, and muriate of soda. It induces intoxication.
Oulton, Norfolk, same as Islington.
Owen Bruen, Cavan, same as Askeron.
Pancras, London, contains sulphate of magnesia and carbonated earth.
Peterhead, Aberdeen, a strong chalybeate.
Passi, near Paris, similar to Pyrmont and Cransac.
Perekop, Russia, a chalybeate.
Pettigre, Donegal, same as Askeron.
Phœnix Park, Dublin, a chalybeate and sulphurous water.
Pisa, Italy, a warm spring: also famed for baths.
Pithkeatly, Perthshire, Scotland, contains muriate of soda, and an earth.
Plombieres, Lorraine, France, a saline and sulphurous warm spring; used in affections of the bladder and asthma; and externally in scrofula and cutaneous diseases.
Pontgibault, France. There are thirty-two springs here, whose temperatures vary from 82° to 124°; their effects are diuretic and laxative.
Pongues, Nivernois, France, contains calcareous earth, magnesia, carbonate of soda, muriate of soda, and siliceous earth; diuretic and aperient.
Pyrmont, Westphalia, contains carbonate of iron, calcareous earth, magnesia, sulphate of magnesia, and muriate of soda. It is diuretic, diaphoretic, and aperient; and used in female complaints, in relaxed habits, in cutaneous and nervous diseases, urinary obstructions; and considered the best restorative in broken constitutions.
Prussia, Warmburn; the only mineral water there.
Queen Carmel, Somersetshire, contains sulphur, muriate of soda, and calcareous earth; is used in scrofulous and cutaneous affections.
Richmond, Surrey, same as Acton.
Rippon, Yorkshire, sulphurous and saline.
Riviera de Abajo, Spain, near Oviedo; said to be similar to Bath.
Road, Wiltshire, a sulphurous and chalybeate water; very strong.
Rykum, Iceland, contains pure soda.
St. Amands, Valenciennes, sulphurous; is used in eruptions, calculous cases, and piles.
St. Bartholomew's, Cork, same as Tilbury.
St. Bernard's, Edinburgh, is a strong sulphurous water, same as Harrowgate; and is used in scorbutic and scrofulous diseases.
St. Erasmus' Well, Staffordshire, same as Barrowdale.
St. Windfrede's, Wiltshire, resembles Malvern.
Sarepta, Russia, a chalybeate.
Scarborough, Yorkshire, contains carbonate of lime, sulphates of magnesia and soda, and iron; is diuretic and purgative.
Scolliensis, Switzerland, contains iron, carbonate of soda, and carbonic acid.
Scool, Clare, is a chalybeate. Sea-water, which contains muriate of soda and magnesia, and selenite.
Sedlitz, Bohemia, contains sulphate of magnesia, and is strongly purgative; is used in stomach, nervous, hemorrhoidal, and œdematous complaints, and in anomalous cases succeeding cessation of the menses.
Seltzer, Germany, contains carbonic acid, carbonate of soda, calcareous earth, and magnesia; is used in gravel, hæmaturia, scurvy, scrofula, dyspepsia, heartburn, acidity, and in billious and calculous disorders.
Sene, or Sende, Wiltshire, is similar to Islington.
Scydschutz, Germany, same as Sedlitz.
Shadwell, near London, contains sulphate of iron.
Shapmoor, Westmoreland, is sulphurous and saline; same as Askeron.
Shettlewood, Derbyshire, is similar to Harrowgate.
Shipton, Yorkshire, same as last-named.
Skibbereen, Cork, a sulphurous water.
Somersham, Huntingdonshire, contains sulphate of iron; applied to old ulcers.
Spa, Germany, contains carbonate of soda, iron, carbonated earth, sulphate of magnesia, and muriate of soda; is used in suppression and retention of menses, hysterical and dropsical affections, and fluor albus.
Spain contains several waters of little note.
Stanger, Cumberland, contains sulphate of iron.
Stenefield, Lincolnshire, similar to Orston.
Streatham, Surrey, contains carbonated earth, sulphate and muriate of magnesia.
Suchaldza, Hungary, similar to Nezdenice.
Sweden mineral waters, said to contain muriate of potass.
Swansea, Glamorganshire, similar to Shadwell.
Swabia, Baden, is a warm sulphurous water; temperature 132°.
Sydenham, Kent, is similar to Epsom.
Tarleton, Lancashire, is similar to Scarborough.
Teutuccia, Italy, famed for baths.
Tewksbury, Gloucestershire, similar to Acton.
Thetford, Norfolk, contains carbonate of soda and iron, and carbonic acid.

Thorston, Nottingham, same as Orston.
Thursk, Yorkshire, same as Scarborough.
Tilbury, Essex, contains carbonate of soda; is diuretic and diaphoretic.
Tibshelf, Derbyshire, is similar to Spa.
Toberbony, Dublin, is an alkaline water.
Tonstein, Germany, is similar to Seltzer.
Toplitz, Bohemia, a saline water; famed also for baths.
Tralee, Kerry, is similar to Castleconnel.
Tunbridge, Kent, contains iron, muriate of soda, and calcareous earth; used in all diseases in which chalybeates are serviceable.
Turkey, waters of, very little known.
Vals, Dauphiny, contains carbonate of soda; is diuretic and diaphoretic.
Vesoul, Upper Soane, is aperient, refrigerant, and diuretic.
Vichy, near Moulins, contains carbonate of soda and sulphate of iron; is used in jaundice, affections of the kidney and bladder, and in sterility.
Viterbo, in Italy, said to contain sulphurous acid.
Wardrew, Northumberland, is similar to Harrowgate.
Wellingborough, Northamptonshire, same as Islington.
West Ashton, Wiltshire, similar to last-named.
Westwood, Derbyshire, same as Shadwell.
Wexford spa, is said to be like Islington.
Wisbaden, Germany, a carbonated water; is famed for baths.
Whiteacre, Lancashire, contains carbonate of iron and lime.
Wildungen, Germany, said to be similar to Bath.
Wildbad, Germany, famed for warm baths.
Witham, Essex, contains carbonate of iron and muriate of soda.
Wirksworth, Derbyshire, sulphurous, saline, and chalybeate.
Wurtemburg, Germany, famed for baths.
Zahorovice, Germany, similar to Nezdenice.

Mineral Waters, Artificial. *To imitate closely Cheltenham water.*—Take Epsom salts 12 grs., iron filings 1 gr., Glauber salts 4 oz., water 4 gals.; mix and impregnate with the gas arising from 2 oz. oil of vitriol, and 2 oz. powdered marble.

Artificial Harrowgate water.—Take common salt 5 oz., water 3 pints; impregnate with gas from liver of sulphur and oil of vitriol, of each 4 oz.

Artificial Pyrmont water.—Take Epsom salts 15 grs., common salt 5 grs., magnesia 10 grs., iron filings 5 grs., water 3 pints; mix and impregnate with gas of marble and oil of vitriol, of each 7 drachms. For further information on this part of the subject, see *Forsyth's Dieteticon*, *Thomson's London Dispensatory* for 1826, &c.

MINERALOGY.

Mineralogy is that department of natural history which teaches us to describe, recognise, and classify the different objects of inorganic nature. The mineral kingdom can never be confounded with either of the others; it comprises within its limits mere masses of dead unorganised matter, subject, as far as we are able to judge, to the laws of chemistry alone, and increasing only by the mechanical addition of extraneous substances; they are not fed by nourishment, nor modified by internal operations, nor supported by any known principle of vitality. Modern mineralogists, indeed, consider this science to treat not only of the earthy and stony substances, which the vulgar have been in the habit of styling minerals, but also of atmospheric air, water, the sulphuric and muriatic acids, and even of hydrogen and carbonic acid gas; at the same time earths loosely aggregated, minerals and many clays, are said to be more properly objects of geological curiosity and economical value, than interesting to the mineralogist (Jameson). We confess this seems to us 'passing strange;' but more of the reigning systems anon.

From a superficial view of minerals in their natural deposits at or near the surface of the earth, it would hardly be supposed possible to arrange them in orders or classify them in groups. Nothing appears further removed from the influence of uniform laws or established principles, than the mineral kingdom, when cursorily observed. It consists of bodies aggregated, not organised, and collected together without the slightest apparent arrangement. All at the first glance appears confusion, while

> Hot, cold, moist and dry, four champions fierce
> Strive here for mastery, and to battle bring
> Their embryon atoms.

But a closer inspection and more comprehensive view of the subject, will convince us that this is 'harmony not understood,' and that this portion of his works is not without the impress of the Deity. To be convinced that the mineral kingdom affords suitable objects for scientific research, we need but glance at two or three of its most interesting phenomena. The properties which some minerals possess of phosphorescence, electricity, and magnetism, may serve to excite the attention of the curious, while the ablest mathematician may find ample employment in the more abstruse problems of crystallisation and polarised light. This is, at the same time, the science which includes within its ample range, the marbles of the statuary and architect, the metals of the manufacturer, the gems of the jeweller, and the soils of the agriculturist. It can never, therefore, be deemed uninteresting or unimportant. Nothing can be more beautiful than the caverns to be met with in primitive rocks, whose walls are lined with pure and variously colored crystallised topaz, beryl, and rock crystal; and the gneiss, granite, and mica slate, with their embedded grains and crystals of sapphire, chrysoberyl, garnet, emerald, axinite, and ruby, seem to realise the oriental tales of diamond valleys and emerald caves. But

it is not the beauties of the gems alone that attract our attention; the varying composition of the mighty masses which compose the crust of the earth's surface, and their conversion into soils, the operations at once mighty and minute which turn the hard and sterile rock into soft and fertile earth, are well worthy of notice. Some idea may be conveyed of the method in which this is performed, by referring to the instance of porcelain granite. 'This substance,' says Sir Humphry Davy, 'consists of three ingredients, quartz, feldspar, and mica. The quartz is almost pure siliceous earth in a crystalline form. The feldspar and mica are very compounded substances; both contain silica, alumina, and oxide of iron; in the feldspar there are usually lime and potassa; in the mica lime and magnesia. When a granite rock of this kind has been long exposed to the influence of air and water, the lime and the potassa contained in its constituent parts are acted upon by water or carbonic acid; and the oxide of iron, which is almost always in its least oxidised state, tends to combine with more oxygen; the consequence is, that the feldspar decomposes, and likewise the mica; but the first the most rapidly. The feldspar, which is as it were the cement of the stone, forms a fine clay; the mica, partially decomposed, mixes with it as sand; and the undecomposed quartz appears as gravel or sand, of different degrees of fineness. As soon as the smallest layer of earth is formed on the surface of a rock, the seeds of lichens, mosses, and other imperfect vegetables which are constantly floating in the atmosphere, and which have made it their resting place, begin to vegetate; their death, decomposition, and decay, afford a certain quantity of organisable matter, which mixes with the earthy materials of the rock; in this improved soil, more perfect plants are capable of subsisting; these in their turn absorb nourishment from water and the atmosphere; and, after perishing, afford new materials to those already provided: the decomposition of the rock still continues; and at length, by such slow and gradual processes, a soil is formed in which even forest-trees can fix their roots, and which is fitted to reward the labors of the cultivator.'

Mineralogy is, however, almost the creation of the last fifty years. Previous to the year 1780, though tolerably understood by many as an art, it could scarcely be deemed a science, being, for want of precise definitions of its objects, incapable of communication; the same substance, from slight variation of appearance, was often denoted by different names, and different substances by the same name; its descriptive language was, for the most part, arbitrary, vague, and ambiguous, each author using that which seemed to him best to answer his purpose. To obviate the confusion thence arising, chemical tests were applied; but even these were found in many cases insufficient, unless the substances exposed to them were thoroughly analysed, a work of great difficulty, involving an intolerable length of time, and, when executed, demonstrative only of the individual substance to which it was applied. When any new specimen occurred, it might still be questioned whether it was or was not of the same nature as that already analysed; recourse must then have been had to description, and thus the same inconveniences recurred.

Since the time of Werner, however, the progress of this science has been rapid, owing greatly to the discoveries in chemistry, but still more to the orderly arrangements and sober attention to facts evinced in the works of the more modern mineralogists. An excessive fondness for theorising, unconnected with accurate observation, was the sin of the scientific writers of the sixteenth and seventeenth centuries; and mineralogy, in common with several other of the physical and experimental sciences, has had more difficulty in removing the rubbish her ill-judging admirers had placed in her way, than in overcoming the natural obstructions of the path. Limestone, for example, was formerly considered as entirely the result of animal action, and the various formations of that rock were viewed as accumulations of altered shells and corals. But neither shells nor corals occur in primitive mountains, although they often contain extensive beds of limestone, and although lime has been proved to enter into the composition of most of the simple minerals of which primitive rocks are composed. It is therefore evident that lime is an original substance in primitive mountains, and has been formed at times independently of animals.

Before the discovery of potassa in lepidolite, a primitive mineral, by Klaproth, this alkali was also considered as entirely a production of the vegetable kingdom; but no vegetable remains occur in primitive rocks; and, therefore, in this case, the potash has been formed by some other agency than that of vegetation. Phosphate of lime, the principal constituent of the bones of animals, was also maintained by the ancient chemists to be invariably an animal production. It, however, has been found in large masses in the primitive formations, and is thus proved to exist in nature, independently of the agency of the organic kingdom.

In this treatise we shall submit to the reader 1st. A history of mineralogy, embracing an account of all the celebrated earlier systems. 2dly. An analysis and comparison of the modern systems. And 3dly, An arrangement and brief notice of the known mineral substances. This will, of course, include only the simple minerals, the description of the compound masses, which form the crust of the earth, having been already given at considerable length in the article GEOLOGY, to which we refer the reader.

PART I.

HISTORY OF MINERALOGY.

The knowledge of some mineral substances must, of course, have been coeval with the earliest ages of the world. Tubal Cain probably discovered the difference between metals, earths, and stones; but the ancients appear to have been totally unacquainted with any thing in the shape of systematic mineralogy; and during the dark ages but little regard was paid to the scanty information to be gleaned from the works of Pliny and Theophrastus. It was not, indeed,

until the introduction of the Arabian chemistry, or alchemy, that any valuable attention was devoted to the study of unorganised bodies.

Avicenna, the 'Prince of Arabian philosophy,' in the eleventh century, divided minerals into four classes, viz. stones, salts, sulphureous or inflammable bodies, and metals; and this arrangement was generally adopted by the chemists of those times. Agricola, the first systematic writer this science can boast, was also the first who paid attention to the external characters of mineral substances. He divided them into simple or homogeneous minerals, and compound or heterogeneous minerals. The simple minerals he divided again into 1. Terra. 2. Succus concretus. 3. Lapis. And 4. Metallum. 'Terra' he defines as a fossil body, which when moistened with water can be rubbed down in the hand, or with which mud may be formed. 'Succus concretus' he calls a dry and moderately hard fossil, which, when moistened with water, either is not softened, or if softened, differs much from the 'terra' in its consistence, or in its composition. 'Lapis' is a fossil, hard and dry, which either long exposure to water scarcely softens, and violent heat converts to dust, or which water cannot soften, but which intense heat melts. 'Metallum' he considers as a fossil by nature, either liquid or hard, but which melts at a violent heat. He divides compound minerals into 1. 'Mixtures of stones and juices (succi).' 2. 'Mixtures of stones and metal.' 3. 'Mixtures of earth and metal.' And 4. 'Mixtures of juice, stone, and metal.' Such is the system of George Agricola; and though his total ignorance of chemical science occasionally led him into error, still it is valuable as the first attempt at mineralogical arrangement, while the logical precision of its execution is such as but few of our modern treatises exhibit.

The celebrated botanist Cæsalpinus was the first who properly separated the salts from the inflammable fossils. The divisions of his system are 1. Mineralia humore solubilia, i. e. minerals dissolvable in water, among which he includes the earths and salts. 2. Mineralia oleo solubilia, i. e. those dissoluble in oil, which contain sulphureous substances, orpiment, &c. 3. Illiquibilia, that cannot be melted, comprehending the rocks, all stones, corals, &c. And 4. Liquibilia, that can be melted, including only the metals.

Many writers on mineralogy appeared at the close of the seventeenth, and the beginning of the eighteenth century. The most celebrated perhaps of these was Joachim Becher, whose Physica Subterranea, in which he proposed to arrange mineral substances on chemical principles, passed through several editions. The stones he divides into 1. 'Those that either calcine or vitrify by heat.' 2. 'Those that preserve their solidity or become friable when ignited.' And 3. 'Those that when ignited, and immersed in water, either remain solid or crumble to pieces.' In his work we, for the first time, find antimony, zinc, and bismuth, classed as semi-metals, and mercury as a compound or decomposed body. The perfect metals of which he has but six, are thus ingeniously distinguished; two of them, gold and silver, melt in a red heat; two, copper and iron, are red-hot before they melt; and two, tin and lead, melt before they can be brought to a red heat. Next he treats of the decomposita, or such minerals as are composed of different earths and stones, earths and metals, or mixtures of metals, and they are divided into terrea, lapidea, metallica, and aquea.

In 1730 Magnus Van Bromell, a pupil of Boerhaave, published a system of mineralogy, in which he not only availed himself of the labors of his predecessors, but also proposed a new chemical division of stony substances into such as are refractory (apyri), such as are calcinable, and such as are vitrescible in the furnace.

After Van Bromell, Linnè appeared, who, in his earlier years, devoted a considerable share of time to the study of mineralogy; and, although his arrangement of the mineral kingdom is far inferior to his masterly systems of zoology and botany, yet this science acquired, through his works, a degree of notice and popularity it had never before enjoyed. It has been justly urged against the applicability of his system, that it is founded on an erroneous principle, viz. on the supposition that the crystalline form of mineral substances is always due to different salts, and that they are to be classed accordingly; but even this error served to direct attention to the important characters derived from the diversity of crystallisation, of which subsequent mineralogists have availed themselves for the distinction and classification of mineral substances. It was in 1736 that his system first appeared, and in this he arranges fossil bodies in three classes, namely petræ, mineræ, and fossilia. These were again subdivided into petræ vitrescentes, calcariæ, and apyræ. Mineræ salia, sulphurea, and mercurialia. And fossilia concreta, petrifacta, and terrestria. This arrangement, however, did not meet with his own final approval; for, in 1768, he published the following system, in which he preserved the outline of his three classes, but altered materially their subdivisions.

Class I. PETRÆ.

Order I. Humosæ.
1. Schistus.

Order II. Calcariæ.
2. Marmor,
3. Gypsum,
4. Stirium,
5. Spatum.

Order III. Argillaceæ.
6. Talcum,
7. Amiantus,
8. Mica.

Order IV. Arenatæ.
9. Cos,
10. Quartzum,
11. Silex.

Order V. Aggregatæ.
12. Saxum.

Class II. MINERÆ

Order I. Salia.
13. Nitrum,
14. Natrum,
15. Borax,
16. Muria,
17. Alumen,
18. Vitriolum.

Order II. Sulphura.
19. Ambra,
20. Succinum,
21. Bitumen,
22. Pyrites,
23. Arsenicum.

Order III. Metalla.
24. Hydrargyrum,
25. Molybdænum,
26. Stibium,
27. Zincum,
28. Vismuthum,
29. Cobaltum,
30. Stannum,
31. Plumbum,
32. Ferrum,
33. Cuprum,
34. Argentum,
35. Aurum.

Class III. FOSSILIA.

Order I. Petrificata.
36. Zoolithus,
37. Ornitholithus,
38. Amphibiolithus,
39. Ichthyolithus,
40. Entomolithus,
41. Helmintholithus,
42. Phytolithus,
43. Graptolithus.

Order II. Concreta.
44. Calculus,
45. Tartarus,
46. Aëtites,
47. Plumex,
48. Stalactites,
49. Tophus.

Order III. Terræ.
50. Ochra,
51. Arena,
52. Argilla,
53. Calx,
54. Humus.

In the mean time the discoveries of Henckel of Saxony, and his coadjutor Pott, had clearly demonstrated the important advantages which mineralogy may derive from chemistry. Much information was afforded by Henckel, particularly with regard to metals and their ores; but the system of external characters was entirely rejected by him as vague and unsatisfactory. More accurate chemical knowledge, however, marks the works of the celebrated Pott, justly styled the Klaproth of his age; and his unremitting attention in submitting to analytic examination the simple earths, enabled him to determine their characters with precision, and arrange them with accuracy. He divides them into four classes, viz. 1. Alkaline earth, or that which by burning forms quicklime, and produces effervescence when dissolved in acids. 2. Siliceous earth, insoluble in acids, but little altered by ignition. 3. Argillaceous earth, which, being viscid and ductile, is capable of being turned in a lathe, becomes hard in the fire, and is insoluble in acids. 4. Gypseous earth, which, by turning, is converted into gypsum which resists the acids; vitrifiable, but with difficulty.

Woltersdorf, the pupil of Pott, proposed a system embracing the whole mineral kingdom on a similar plan; but his chemical knowledge appears to have been inadequate to the task which he undertook, and his system is therefore imperfect. He comprehended the mineral kingdom under seven classes, in the following manner:—

1. Terræ.
Argillaceæ,
Alkalinæ.

2. Lapides.
Vitrescentes,
Argillacei,
Gypsei,
Alkalini.

3. Salia.
Acida,
Alkalina,
Intermedia.

4. Bitumina.
Fluida,
Solida.

5. Semimetalla.
Fluida,
Solida.

6. Metalla.
Nobilia,
Ignobilia.

7. Petrifacta.
Sanguineorum,
Insecta,
Testacea,
Vegetabilia,
Marina.

Nearly about the same time Wallerius published his Mineral uke indelt och Beskrifirt, in a second edition of which he thus completes his arrangement:—

Class I. Terræ.
Macræ,
Tenaces,
Minerales.

Class II. Lapides.
Calcarei,
Vitrescentes,
Fusibiles,
Apyri,
Saxa.

Class III. Mineræ.
Salia,
Sulphura,
Semimetalla,
Metalla.

Class IV. Concreta.
Pori,
Petrifacta,
Figurata,
Calculi.

Wallerius was the first by whom the principles on which systematic writers had hitherto arranged mineral substances were subjected to a strict examination. He rejected all characters derived from the value, use, or geognostic situation, and established it as a rule that the order and genera should be founded on chemical characters alone, while the species should be principally determined by their external character. The genera were distinguished by him with great precision, and augmented by the addition of some new ones. In these respects Waller holds a distinguished place among mineralogical writers, and his work may be advantageously consulted by the student of oryctognosy.

The appearance of Cronstedt of Stockholm, as a writer on mineralogy, forms an important epoch in the history of that science. In his work (Forsogtil Mineralogie, Stockholm 1758), he commences with some highly interesting and important observations on the gradual effects produced by fire and water on mineral substances, and on the slow, but unremitted changes they experience from various physical and chemical agents in the bowels of the earth. His system is throughout chemical, and the principles on which the classes and orders are established are still pretty generally acknowledged by systematic writers. He was the first who showed that petrifactions ought not to occupy a separate place in the system merely on account of their form, and also that the compound primitive rocks are not admissible into a system which professes to treat only of simple substances. For the first time, we find the then newly discovered platina, and also nickel, one of Cronstedt's own discoveries. The following brief sketch may serve to give the reader some idea of his method of arrangement:

Class I. Terræ.		Class II. Salia.	Class III. Phlogistica.	Class IV. Metalla.
1. Calcareæ	6. Fluores.	1. Acida.	or	1. Perfecta.
2. Siliceæ.	7. Asbestinæ.	2. Alkalina.	Bitumina.	2. Semimetalla.
3. Granatinæ	8. Zeolithicæ.		including	
4. Argillaceæ.	9. Magnesiæ.		Plumbago.	
5. Micaceæ.				

No work on mineralogy ever created a greater sensation than that of Cronstedt. In a short time after its appearance, it was translated into almost all the European languages; in all civilised countries the system was studied; and with some occasional deviations was adopted by most writers on minerals. Yet this system is not without great defects, and it is a matter of great difficulty to become acquainted with a mineral by consulting the description he gives of it. Cronstedt improved the classification of minerals, but the task of giving perfection to description, so indispensably necessary for the diagnosis of fossils, was reserved for his successor, whom it now becomes our duty to notice.

The celebrated Abraham Werner first published his classical work on the external character of minerals (Vonden äuffem Kennzeichen der Fossilien, Leipsic) in 1774; laid the foundation of a settled descriptive terminology that entirely banished the vague and arbitrary language then in use, and justly entitled its author to the title of the 'father of systematic mineralogy.' 'In this work,' says professor Jameson, 'he gave the first example of the true method of describing mineral species. In these descriptions, all the characters presented by the species-suite are detailed with a certain degree of minuteness, and in a determinate order; so that we have a complete picture of it, and are furnished with characters that distinguish it from all known species, and from every mineral that may hereafter be discovered.'

In 1780 Werner published a German translation of Cronstedt's mineralogy with copious notes, in which he gives an outline of his own ideas respecting a system of oryctognosy. All the other expositions of his system are by his pupils; they are of various merit, and some of them but ill-calculated to convey an adequate idea of its excellencies. Mr. Kirwan was the first who introduced it in this country; but for the most complete account of it we are indebted to professor Jameson of Edinburgh.

The fundamental principle laid down by Werner, in the systematic arrangement of fossile bodies, is the natural affinity, which he allows to be founded on the chemical mixture of their component parts. The Wernerian arrangement is, therefore, to a certain degree a mixed method. It is not supposed that an arrangement founded on these principles will always coincide with the experiments of the chemist; for it is only when chemical results agree with the natural alliances of the system that they are permitted to have a place in it, and in most cases where no satisfactory analysis existed of the mineral, the external characters alone decided its genus. In forming the metallic genera, says Werner, an attention to the constituent parts of minerals is unavoidable; for, were these genera to be established by external characters, independent of chemical analysis, the various species of ores, belonging to the same metal, would not always be collected into the same genus. Indeed several species of ores would undoubtedly be arranged among earthy minerals. Thus no one, relying on external characters only, would associate carbonate of lead with the other ores of that metal, nor even place it in any metallic genus. But in the natural history method of arrangement chemistry is entirely neglected, and different ores of the same metal are widely separated from each other. The reasons given for this alteration will be discussed anon.

Werner enumerates three different kinds of affinity in minerals, viz. the chemical, depending on a similarity of component parts, the mineralogical, consisting in the resemblance of their external characters, and the geological affinity

denoting a similarity of situation, relative age, &c.

The divisions and subdivisions introduced by Werner into the mineral kingdom are as follows; viz. class, order, genus, species, sub-species, kind. Certain species having a general resemblance have been collected into families, as the zeolite family, the felspar family. There are four classes, viz. earths, salts, inflammables, and metals. Each class is subdivided into genera. In most cases the genera are determined by the earth, salt, combustible, or metal, which is supposed to be either the predominant, or characteristic ingredient. It will be observed that a distinction is here made between the predominant and characteristic ingredient. It is indeed commonly the case, that the characteristic ingredient, or that which is most effective in producing the peculiar characters of the mineral, is also predominant in quantity. But there are some minerals which are not characterised by that ingredient which is present in the largest proportion. This distinction is undoubtedly important; and could we, in cases of minerals composed of several earths, estimate the relative energies as well as the relative quantities of the different ingredients, we might ascertain all that is essential to their true composition.

The following tabular sketch of the arrangement of the genera of Werner in 1789 will enable the reader to judge of the comparative merit of his system, and those of his predecessors:—

Wernerian System, 1789.

Class I.—EARTHS.

Order I.—Siliceous.

Genera.	Genera.
1. Lapis diaboli,	15. Quartz,
2. Diamond,	16. Hornstone,
3. Chrysoberyl,	17. Flint,
4. Zircon,	18. Chalcedony,
5. Hyacinth,	19. Lithoxylon,
6. Chrysolite,	20. Heliotrope,
7. Garnet,	21. Chrysoprase,
8. Ruby,	22. Schistous silex,
9. Sapphire,	23. Obsidian,
10. Topaz,	24. Cat's eye,
11. Emerald,	25. Phrenite,
12. Beryl,	26. Zeolite,
13. Schorl,	27. Lapis lazuli.
14. Lapis thumensis,	

Order II.—Argillaceous.

Genera.	Genera.
1. Pure argil,	15. Coticula,
2. Porcelain earth,	16. Tripoli,
3. Common clay,	17. Mica,
4. Jasper,	18. Chlorite,
5. Opal,	19. Chalkolite,
6. Pitchstone,	20. Hornblende,
7. Adamantine spar,	21. Wacke,
8. Felspar,	22. Basalt,
9. Clay state,	23. Lava,
10. Bituminous state,	24. Pumice,
11. Aluminous earth,	25. Green earth,
12. Aluminous schist,	26. Lithomarge,
13. Aluminous stone,	27. Mountain soap,
14. Nigrica,	28. Ochre.

Order III.—Talcs.

Genera.	Genera.
1. Steatite,	6. Serpentine,
2. Nephrite,	7. Talc,
3. Fuller's earth,	8. Asbestus,
4. Meerschaum,	9. Cyanite,
5. Bole.	10. Actinolite.

Order IV.—Calcareous.

Genera.	Genera.
1. Cactiform,	11. Bituminous marly schist,
2. Chalk,	12. Apatite,
3. Marble,	13. Boracite,
4. Compact marble,	14. Fluor,
5. Stalactite,	15. Gypsum,
6. Pisolite,	16. Selenite,
7. Slaty spar,	17. Witherite,
8. Magnesiac spar,	18. Ponderous spar
9. Swine-stone,	
10. Marl,	

Class II.—SALTS.

Order I.—Vitriolic.

Genera.	Genera.
1. Native vitriol,	4. Halotrichum,
2. Rock butter,	5. Native salamur
3. Alum,	

Order II.—Nitrous.

Genus.
Common native saltpetre.

Order III.—Muriatic.

Genera.	Genera.
Common rock salt,	Sal ammoniac

Order IV.—Borax.

Genus.
Native Borax.

Order V.—Alcaline.

Genus.
Natural mineral alkali.

Class III.—INFLAMMABLES.

Order I.—Bituminous.

Genera.	Genera.
1. Naphtha,	5. Petroleum,
2. Asphalt,	6. Spissexylon,
3. Coal,	7. Meliedite.
4. Amber,	

Order II.—Sulphureous.

Genera.
1. Common native sulphur,
2. Volcanic sulphur.

Order III.—Graphite.

Genus.
Native graphite.

Class IV.—METALS.

Genera.	Genera.
1. Platina.	Mercurial hepatic ore,
Native platina.	Cinnabar.
2. Gold.	4. Silver.
Native gold.	Native silver,
Nagiaker ore.	Nagiaker silver,
3. Mercury.	Arsenical silver,
Native mercury	Horn ore
Native amalgam,	Black silver ore
Mercurial horn ore,	Vitreous silver ore

Genera.	Genera.
Brittle silver ore	Yellow lead earth,
Red silver ore	Gray lead earth,
White silver ore.	Red lead earth,
5. Copper.	8. Tin.
Native copper,	Tin pyrites,
Copper glance,	Tinstone,
Variegated copper ore,	Cornish tin ore.
Copper pyrites,	9. Bismuth.
White copper ore,	Native bismuth,
Gray copper ore,	Bismuth glance,
Black copper,	Bismuth ochre.
Red copper ore,	10. Zinc.
Tile ore,	Blende,
Azure copper,	Calamine.
Malachite,	11. Antimony.
Copper green,	Native antimony,
Iron-shot copper green,	Gray antimony ore,
Olivine ore.	Red antimony ore,
6. Iron.	White antimony ore,
Native iron,	12. Manganese.
Iron pyrites,	Gray manganese ore,
Magnetical pyrites,	Black manganese ore,
Magnetical iron ore,	Red manganese ore.
Iron glance,	13. Nickel.
Red ironstone,	Copper nickel,
Brown ironstone,	Nickel ochre.
Sparry ironstone,	14. Cobalt.
Clay ironstone,	Gray cobalt ore,
Bog iron ore,	Glance cobalt,
Blue iron earth,	Black earthy cobalt,
Green iron earth,	Brown earthy cobalt,
Emery,	Yellow earthy cobalt,
Pitchblende.	Red cobalt.
7. Lead.	15. Arsenic.
Lead glance,	Native arsenic,
Blue lead ore,	Arsenical pyrites,
Brown lead ore,	Orpiment.
White lead ore,	16. Molybdena.
Green lead ore,	Molybdena.
Black lead ore,	17. Scheelium.
Red lead ore,	Tungsten,
Yellow lead ore,	Wolfram.

This system exhibits some curious anomalies. Thus sapphire is placed in the siliceous genus although composed of alumine nearly pure. But this stone is thus arranged in perfect conformity with the principles of the system; for a certain number of external characters, which siliceous minerals usually exhibit, being taken for the type of the genus, every mineral possessing these characters is to be arranged under this genus whether it contain any silex or not. Two other instances may be adduced of minerals arranged merely in consequence of their external characters in direct opposition to their true composition. One of these is the diamond, composed of pure carbon, and belonging to the class of combustibles; the other hallite or halyt from the Greek ἁλς, a salt, and which is in fact a genus of salts though arranged with the earths.

Such was the Wernerian arrangement of 1789. We shall now give, from professor Jameson's celebrated work on Mineralogy, his edition of Werner's system in 1815. For although other systems were in the mean time published by various authors, yet, in order to present the reader at one view with the whole of the Wernerian Mineralogy, we shall defer their present consideration, proceeding at once to *Werner's Mineral System in* 1815.

Class I.—EARTHY FOSSILS.

1. DIAMOND GENUS.

Diamond.

2. ZIRCON GENUS.

Zircon Family.

2. Zircon,	4. Cinnamon-stone
3. Hyacinth,	

3. FLINT GENUS.

Augite Family.

5. Chrysoberyl,	*c.* Conchoidal,
6. Chrysolite,	*d.* Common.
7. Olivine,	10. *Baikalite,*
8. Coccolite,	11. Sahlite,
9. Augite,	12. Diopside,
a. Granular,	13. *Fassaite.*
b. Foliated,	

Garnet Family.

14. Vesuvian,	21. Garnet,
15. Grossulare,	*a.* Precious,
16. Leucite,	*b.* Common.
17. *Pyrenite,*	22. Staurolite or grenatite,
18. Melanite,	
19. Allochroite,	23. Pyrope.
20. *Colophonite,*	

Ruby Family.

24. Automalite,	29. Corundum,
25. Ceylanite,	30. Diamond-spar,
26. Spinel,	———
27. Sapphire,	31. Topaz
28. Emery,	

Beryl Family.

32. Iolite,	*a.* Precious beryl,
33. Euclase,	*b.* Common,
34. Emerald,	36. Schorlous beryl,
35. Beryl,	37. Tourmaline.

Pistacite Family.

38. Lievrite,	42. Anthophylite,
39. Pistacite,	*a.* Radiated,
40. Diaspore,	*b.* Foliated,
41. Zoisite,	43. Axinite.

Quartz Family.

44. Quartz,	*b.* Carnelian,
a. Amethyst,	*α.* Common,
α. Common,	*β.* Fibrous,
β. Thick fibrous,	50. Hyalite,
b. Rock crystal,	51. Opal,
c. Milk quartz	*a.* Precious,
d. Common quartz,	*b.* Common opal,
e. Prase,	*c.* Semi-opal,
45. Iron-flint,	*d.* Wood-opal,
46. Hornstone,	52. Menilite,
a. Splintery,	*a.* Brown menilite
b. Conchoidal,	*b.* Gray menilite
c. Woodstone,	53. Jasper,
47. Flinty-slate,	*a.* Egyptian jasper
a. Common,	*α.* Red,
b. Lydian-stone,	*β.* Brown,
48. Flint,	*b.* Striped jasper,
49. Chalcedony,	*c.* Porcelain jasper,
a. Common,	*d.* Common jasper,

a. Conchoidal,
β. Earthy,
e. Opal jasper,
f. Agate jasper,
54. Heliotrope,
55. Chrysoprase,
56. Plasma,
57. Cat's eye,
58. *Faser Kiesel,*
59 Elaolite.

Pitchstone Family.

60. Obsidian,
61. Pitchstone,
62. Pearlstone,
63. Pumice.

Zeolite Family.

64. Phrenite,
a. Fibrous,
b. Foliated,
65. Natrolite,
66. Zeolite,
a. Mealy Zeolite,
b. Fibrous do.
c. Radiated zeolite,
d. Foliated do.
67. Ichthyophthalm,
68. Cubicite,
69. Cross-stone or crucite,
70. Laumonite,
71. Schmelzstein.

Azurestone Family

72. Azurestone,
73. Azurite.
74. Blue-spar.

Felspar Family.

75. Andalusite,
76. Felspar,
a. Adularia,
b. Labrador,
c. Glassy,
d. Common felspar,
α. Fresh,
β. Disintegrated,
e. Hollow spar,
f. Compact felspar,
α. Common,
β. Variolite,
77. Spodumene,
78. Scapolite,
a. Red scapolite,
b. Gray scapolite,
α. Radiated,
β. Foliated,
79. Meïonite,
80. Nepheline,
81. Ice-spar.

4. Clay Genus.

Clay Family.

82. Pure clay,
83. Porcelain earth,
84. Common clay,
a. Loam,
b. Potter's clay,
α. Earthy,
β. Slaty,
c. Variegated clay,
d. Slate clay,
85. Claystone,
86. Adhesive slate,
87. Polishing or polier state,
88. Tripoli,
89. Floatstone,
90. Alum-stone.

Clay-Slate Family.

91. Alum-slate,
a. Common,
b. Glossy,
92. Bituminous shale,
93. Drawing-slate,
94. Whet-slate,
95. Clay-slate.

Mica Family.

96. Lepidolite,
97. Mica.
98. Pinite,
99. Potstone,
100. Chlorite,
a. Chlorite earth.
b. Common chlorite,
c. Chlorite slate,
d. Foliated chlorite.

Trap Family.

101. *Paulite,*
102. Hornblende,
a. Common,
b. Basaltic,
c. Hornblende-slate,
103. Basalt,
104. Wacke,
105. Clinkstone,
106. Iron clay,

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107. Lava.

Lithomarge Family.

108. Green earth,
109. Lithomarge,
a. Friable,
b. Indurated,
110. Rock-soap,
111. Umber,
112. Yellow earth.

5. Talc Genus.

Soapstone Family.

113. Native magnesia, or talc-earth,
114. Meerschaum,
115. Bole,
116. Fuller's earth,
117. Steatite,
118. Figurestone.

Talc Family.

119. Nephrite,
a. Common nephrite,
b. Axe-stone,
120. Serpentine,
a. Common,
b. Precious,
α. Conchoidal,
β. Splintery,
121. Schillerstone,
122. Talc,
a. Earthy,
b. Common,
c. Indurated,
123. Asbestus,
a. Rock-cork,
b. Amianthus,
c. Common asbestus,
d. Rock-wood.

Actynolite Family.

124. Kyanite,
125. Actynolite,
a. Asbestous,
b. Common,
c. Glassy,
d. Granular,
126. *Spreustein or chaff-stone.*
127. Tremolite,
a. Asbestous,
b. Common,
c. Glassy,
128. Sahlite,
129. *Rhætizite.*

6. Calcareous Genus.

A. *Carbonates.*

130. Rock milk,
131. Chalk,
132. Limestone,
a. Compact,
α. Common,
β. Roestone,
b. Foliated,
α. Granular,
β. Calcareous spar,
c. Fibrous,
α. Common,
β. Calc-sinter,
d. Pea-stone,
133. Calc-tuff,
134. Schaum earth, or foam earth,
135. Slate spar,
136. Brown spar,
a. Foliated,
b. Fibrous,
137. Schaalstone,
138. Dolomite,
139. Rhomb-spar,
140. *Anthracolite.*
141. Stinkstone,
142. Marl,
a. Marl earth,
b. Indurated marl,
143. Bituminous marl-slate,
144. Arragon,
a. Common,
b. Prismatic.

B. *Phosphates.*

145. Appatite,
146. Asparagus stone.

C. *Fluates.*

147. Fluor,
a. Compact,
b. Fluor spar.

D. *Sulphates*

148. Gypsum,
a. *Spumous gypsum.*
b. Earthy gypsum,
c. Compact gypsum,
d. Foliated gypsum,
e. Fibrous gypsum,
149. Selenite,
150. Muriacite.
a. Anhydrite,
b. *Gekröstein,*
c. Conchoïdal mur
d. Fibrous mur.
e. Compact mur.

E. *Borates*

151. Datolite,
152. Boracite,
153. Botryolite.

7. Baryte Genus.

154. Witherite,
155. Heavy spar,
a. Earthy heavy spar,
b. Compact heavy-spar,
c. Granular heavy-spar,
d. Curved lamellar heavy-spar,
e. Straight lamellar, heavy-spar,

a. Fresh,
β. Disintegrated,
f. Columnar spar,
g. Prismatic spar,
h. Bolognese, or Bolognian spar.

8. Strontian Genus.

156. Strontian,
a. Compact,
b. Radiated,
157. Celestine,
a. Fibrous,
b. Radiated,
c. Lamellar,
d. Prismatic.

9. Hallite Genus.

158. Cryolite.

Class II.—FOSSIL SALTS.

1. *Carbonates.*
159. Natural soda or natron.
2. *Nitrates.*
160. Natural nitre.
3. *Muriates.*
161. Natural rock-salt,
a. Stone-salt,
α. Foliated,
β. Fibrous.
b. Lake-salt,
162. Natural sal-ammoniac.
4. *Sulphates.*
163. Natural vitriol,
164. Hair-salt,
165. Rock-butter,
166. Natural Epsom-salt,
167. Natural Glauber-salt.

Class III.—INFLAMMABLE FOSSILS.

1. Sulphur Genus.

168. Natural sulphur,
a. Crystallised,
b. Common,
α. Earthy,
β. Conchoidal,
c. Mealy,
d. Volcanic.

2. Bituminous Genus.

169. Mineral or fossil oil,
170. Mineral pitch,
a. Elastic,
b. Earthy,
c. Slaggy,
171. Brown coal,
a. Bituminous wood,
b. Earth coal,
c. Alum earth,
d. *Paper coal,*
e. Common brown, coal,
f. Moor coal,
172. Black coal.
a. Pitch coal,
b. Columnar coal,
c. Slate coal,
d. Cannel coal,
e. Foliated coal,
f. Coarse coal.

3. Graphite Genus.

173. Glance-coal,
a. Conchoidal,
b. Slaty,
174. Graphite,
a. Scaly,
b. Compact,
175. Mineral charcoal.

4. Resin Genus.

176. Amber,
a. White,
b. Yellow,
177. Honey stone.

Class IV.—METALLIC FOSSILS.

1. Platina Genus.

178. Native Platina.

2. Gold Genus.

179. Native gold,
a. Gold yellow,
b. Brass yellow,
c. Grayish yellow.

3. Mercury Genus.

180. Native mercury,
181. Natural amalgam,
a. Semi-fluid,
b. Solid,
182. Mercurial horn-ore,
183. Mercurial liver-ore,
a. Compact,
b. Slaty,
184. Cinnabar,
a. Dark red,
b Light red

4. Silver Genus.

185. Native silver,
a. Common,
b. Auriferous,
186. Antimonial silver,
187. Arsenical silver,
188. *Molybdena silver,*
189. Corneous silver-ore, or horn-ore,
190. Silver-black,
191. Silver-glance,
192. Brittle silver-glance,
193. Red silver-ore,
a. Dark,
b. Light,
194. White silver-ore.

5. Copper Genus.

195. Native copper,

Family of Copper Sulphurets.
196. Copper-glance,
a. Compact,
b. Foliated,
197. Variegated copper-ore,
198. Copper-pyrites,
199. White copper-ore.
200. Gray copper-ore,
201. Black copper-ore,

202. Red copper-ore,
a. Compact,
b. Foliated,
c. Capillary,
203. Tile-ore,
a. Earthy,
b. Indurated,
204. Azure copper-ore,
a. Earthy,
b. Indurated or radiated,
205. *Velvet copper-ore,*
206. Malachite,
a. Fibrous,
b. Compact,
207. Copper-green,
208. Ironshot copper-green,
a. Earth,
b. Slaggy,
209. Emerald copper-ore,
210. Copper mica,
211. Lenticular-ore
212. Oliven-ore,
213. Muriate of copper,
214. Phosphate of copper.

6. Iron Genus.

215. Native iron,
216. Iron-pyrites.
a. Common pyrites,
b. Radiated pyrites,
c. Liver or hepatic pyrites,
d. Cock's-comb pyrites,
e. Cellular pyrites,
217. Capillary pyrites,
218. Magnetic pyrites,
219. Magnetic ironstone,
a. Common,
b. Iron-sand,
220. *Chrome-ironstone,*
221. *Menac ironstone,*
222. Iron-glance,
a. Common,
α. Compact,
β. Foliated,
b. Iron-mica,
223. Red ironstone,
a. Red iron-froth,
b. Ochry red ironstone,
c. Compact,
d. Red hæmatite,
224. Brown ironstone,
a. Brown iron froth,
b. Ochry brown ironstone,
c. Compact,
d. Brown hæmatite,
225. Sparry ironstone,
226. Black ironstone,
a. Compact,
b. Black hæmatite,
227. Clay-ironstone,
a. Reddle,
b. Columnar clay-ironstone,
c. Lenticular clay-ironstone,
d. Jaspery clay-ironstone,
e. Common clay-ironstone,
f. Reniform clay-ironstone,
g. Pea-ore, or pisiform ironstone,
228. Bog iron-ore,
a. Morass-ore,
b. Swamp-ore,
c. Meadow-ore,
229. Blue iron-earth,
230. Pitchy iron-ore,
231. Green iron-earth,
232. Cube-ore,
233. Gadolinite.

7. Lead Genus.

234. Galena, or Lead-glance,
  a. Common,
  b. *Disintegrated*,
  c. Compact,
235. Blue lead-ore,
236. Brown lead-ore,
237. Black lead-ore,
238. White lead-ore,
239. Green lead-ore,
240. Red lead-ore,
241. Yellow lead-ore,
242. Lead-vitriol,
243. Earthy lead-ore, or lead earth,
  a. Coherent,
  b. Friable.

8. Tin Genus.

244. Tin pyrites,
255. Tinstone,
246. Cornish tin-ore.

9. Bismuth Genus.

247. Native bismuth,
248. Bismuth-glance,
249. Bismuth-ochre,
250. *Arsenical bismuth-ore*.

10. Zinc Genus.

251. Blende,
  a. Yellow,
  b. Brown,
    α. Foliated,
    β. Fibrous,
    γ. Radiated,
  c. Black,
252. Calamine.

11. Antimony Genus.

253. Native antimony,
254. Gray antimony-ore,
  a. Compact,
  b. Foliated,
  c. Radiated,
  d. Plumose,
255. Black antimony-ore,
256. Red antimony-ore,
257. White antimony-ore,
258. Antimony-ochre.

12. Sylvan Genus.

259. Native sylvan,
260. Graphic-ore,
261. White sylvan-ore,
262. Nagyag-ore.

13. Manganese Genus.

263. Gray manganese-ore,
  a. Radiated,
  b. Foliated,
  c. Compact,
  d. Earthy,
264. Black manganese-ore,
265. *Piedmontese manganese-ore*,
266. Red manganese ore,
267. *Manganese-spar*.

14. Nickel Genus.

268. Copper-nickel,
269. *Capillary-pyrites*,
270. Nickel-ochre.

15. Cobalt Genus.

Family of Speiss Cobalt.

271. White cobalt-ore,
272. Gray cobalt-ore,
273. Glance-cobalt.

Family of Cobalt-Ochre.

274. Black cobalt-ochre,
  a. Earthy,
  b. Indurated,
275. Brown cobalt-ochre,
276. Yellow cobalt-ochre,
277. Red cobalt-ochre,
  a. Cobalt-crust,
  b. Cobalt-bloom.

16. Arsenic Genus.

278. Native arsenic,
279. Arsenic pyrites,
  a. Common,
  b. Argentiferous,
280. Orpiment,
  a. Yellow,
  b. Red,
281. Arsenic bloom.

17. Molybdena Genus.

282. Molybdena.

18. Sheele Genus.

283. Tungsten,
284. Wolfram.

19. Menachine Genus.

285. Menachan,
286. Octahedrite,
287. Rutile,
288. Nigrine,
289. Iserine,
290. Brown menachine-ore,
291. Yellow menachine-ore.

20. Uran Genus.

292. Pitch-ore,
293. Uran-mica,
294. Uran-ochre.

21. Chrome Genus.

295. Acicular-ore,
296. Chrome-ochre.

22. Cerium Genus.

297. Cerium-stone.

Having given this general idea of Werner's system, we cannot proceed to notice that of Bergman without making honorable mention of the celebrated Romé d l'Isle, whose indefatigable researches so eminently contributed to the progress of the science, and whose Christallographie ou Description des formes propres à tous les corps du regne Minerale, published in 1783, has been deservedly characterised as the result of labors immense in their extent, almost entirely novel in their object, and of the highest importance on account of their utility.

In this elaborate performance the author gives a description of the forms proper to every substance of the mineral kingdom, in a saline, stony, and metallic combination; with figures of all the known crystals, arranged according to the number and disposition of their angles. He asserts, which is generally admitted, that every species in the mineral kingdom always takes a polyhedral primitive form, which is regular, constant, and peculiar to itself. See Crystallography.

The celebrated Bergman, who succeeded Wallerius in the mineralogical chair of Upsal, also published a sketch of a mineral system in his Physical Description of the Earth, 1784. He divided the mineral kingdom into four classes in the following manner:—

Class I. Salia.

Orders.

1. Acida.
2. Alkalina.
3. Neutralia.
4. Terrestria.
5. Metallina.
6. Tripliciter combinata.

Class II. Terræ.

Orders.

1. Ponderosæ.
2. Calx.
3. Magnesiæ.
4. Argillaceæ.
5. Siliciæ.

Class III. Bitumina.

Orders.

1. Bitumen.
2. Petroleum.
3. Adamas.

Class IV. Metalla.

Including all the metals in one order.

The next writer of importance is the celebrated Kirwan of Dublin, the founder of the Dublin Mineralogical Society, and the first who introduced the Wernerian system to notice in this country. His Elements of Mineralogy, which appeared in 1784, may be considered as the first work of importance on the subject published in

Great Britain, and principally excited that attention to the science which it has since so deservedly enjoyed. The following extract will exhibit the most prominent features of his mineralogical arrangement :—

The classification of earths, says Mr. Kirwan, and stones, consists in their arrangement in a certain order relatively to each other.

Order, when not arbitrary, necessarily supposes both distinction and resemblance. Without distinction all the bodies to be arranged would be equally entitled to the same place in the series. Without resemblance no reason could be assigned why a body should occupy one particular place rather than another place, there being no relation to connect it with the preceding.

Hence it follows that those bodies which resemble each other most should be grouped together; and, consequently, that there should be as many heads of general division as there are general grounds of resemblance.

If it be asked whence this resemblance should be taken; whether from the external or internal characters? I answer, it should be taken from both, it being the result of the joint consideration of both.

Now, upon examining the totality of homogeneous earths and stones, it will be found that those resemble each other most that contain the largest proportion of the same simple earth, or most of the characterising properties of the same simple earth; and, as there are nine simple earths, it follows that there must be nine genera, or primary divisions of homogeneous earths and stones. In the same manner, under each head or genus, we may consider those substances as specifically different that resemble each other least, or that differ in some important property relatively to human uses; for systems being fabricated to help the memory, by pointing out the most important distinctions, and none being more so than those that are applicable to human uses, should never lose sight of their primary end and designation.

Hence, 1. The generic earths, combined with an acid, are specifically different from those that are not. 2. The same generic earth, combined with different acids, forms different species. 3. The same generic earth, combined with a notable proportion of one or more of the other earths, forms a different species from the same generic earth, either uncombined or combined with a less important proportion of other earths. I call a proportion, continues this writer, notable or important when it introduces a considerable alteration in the external or internal characters of the compound. Thus such a proportion as induces a considerable change in the specific gravity, or in the fusibility of any substance, is notable or important; so in the calcareous genus such a proportion of foreign earth, or earths, as would prevent it from burning to lime, is certainly of importance, and the distinction grounded in nature: so proportions that alter the fusibility of substances, with respect to the degree at which they are fusible, are certainly notable, and a good foundation for specific distinctions. But varieties of proportion, or even of ingredients, that produce no notable change, either in the internal or external properties of a compound, make no alteration in the species; and in fact there are scarcely any earths or stones that have, strictly speaking, the same proportion of ingredients. Traps or basalts, and zeolytes, vary considerably. 4. Any earth which forms less than one-twentieth of a compound, is almost always of little importance. 5. Water forms an important part of any compound when it exceeds one twenty-fifth of the whole. 6. Calces of iron influence in some measure the properties of a compound, when they exceed one thirty-third of the whole. If they are themselves magnetic, they communicate that property to compounds of which they form above one-tenth.

Species are further divisible from some particular points of agreement into families, or classes and families; sometimes it is necessary to form distinctions where specific characters are not decided; in which case I distribute the classes into tribes and families, as will be seen in the sequel. The minuter diversifications are called varieties. The term specimen corresponds with that of individual in the animal kingdom.

In this system Mr. Kirwan adopted the classes of Werner, but varied the orders and distribution of the genera as follows :—

Class I.—EARTHS.

This class includes the orders Calcareous, Barytic, Muriatic, Argillaceous, Siliceous, Aggregate, and Mixed Earth, and each order the following genera :—

Order I. Calcareous.

Genera.	Genera.
Native lime,	Marlite,
Aerated calx,	Pyritaceous limestone
Agaric mineral chalk,	Argentine,
Arenaceous limestone,	Sidero-calcite,
Testaceous tufa,	Ferro-calcite,
Compact limestone,	Elastic marble,
Swinestone,	Gypsum,
Oviform,	Fluor,
Baryto-calcite,	Phosphorite,
Muri-calcite,	Tungsten.
Marl,	

Order II. Barytic.

Genera.	Genera.
Baroselenite,	Liver-stone.

Order III. Muriatic.

Genera.	Genera.
Kiffekil,	Asbestus,
Martial muriatic spar,	Amianth,
Calci-murite,	Mountain-cork,
Argillo-murite,	Amianthinite,
Chlorite,	Asbestinite,
Talcite,	Actinolite,
Talc,	Jade,
Steatite,	Boracite,
Pot-stone,	Baikalite.
Serpentine,	

Order IV. Argillaceous.

Genera.	Genora.
Native argill,	Potter's clay,
Porcelain clay,	Indurated clay,

Schistose,	Micarelli,
Shale,	Hornblend,
Fuller's earth,	Basaltine,
Lithomarge,	Labrador hornblend,
Bole,	Schiller spar,
Argillaceous marl,	Schistose hornblend,
Colored chalk,	Wacken,
Green earth,	Muller,
Umber,	Kragg,
Tripoli,	Trapp,
Phospholite,	Basalt,
Lepidolite,	Calp,
Sapparre,	Argillite,
Mica,	Novaculite.

Order V. SILICEOUS.

Genera.	Genera.
Quartz,	Chalcedony,
Amethyst,	Cat's eye,
Emerald,	Flint,
Beryl,	Hornstone,
Prase,	Schisthose hornstone,
Oriental ruby,	Siliceous schist,
Spinel,	Basamite,
Accidental ruby,	Hornslate,
Hyacinth,	Japper,
Garnet,	Egyptian pebble,
Chrysoberyl,	Sinople,
Chrysolite,	Porcellanite,
Olivin,	Heliotrope,
Obsidian,	Woodstone,
Shorl,	Elastic quartz,
Tourmalin,	Felspar,
Thumerstone,	Labrador-stone,
Phrenite,	Petrile,
Ædilite,	Felzite,
Zeolite,	Argentine felspar,
Stauwhite,	Red-stone,
Kubellite,	Siliceous spar,
Opal,	Agate,
Semiopal,	Stronthian,
Pitchstone,	Jargon,
Hydrophanes,	Sidneia,
Hyalite,	Adamantine earth.

Order VI. AGGREGATE.

Genera.	Genera.
Granite (quartz, felspar, mica).	Granilite (aggregates of four).
Sienite (quartz, felspar, hornblend, or quartz,felspar,hornblend, mica).	Gneiss,
Granitine triplets, formed of any triple aggregation.	Schistose, mica (quartz and mica).
Norka, or murker (quartz, mica, garnet).	Porphyry,
Grunsten (hornblend and mica, hornblend and felspar.	Amygdaloid,
Granitell (duplicates), Stellstein (quartz and mica).	Pudding-stone,
Rapikivi (felspar and mica).	Sand-stones,
	Rubble-stone,
	Breccias,
	Nagel fluhe,
	Anomalous grits,
	Horn rock,
	Serpentine rock,
	Topaz rock,
	Garnet rock,
	Steatitic rock
	Variolites.

Order VII. MIXED EARTHS.

Genera.	Genera.
Lime-stones,	Spars,
Calces of iron,	Marls,
Gypsum,	Trap,
Potstone,	Argillite,
Steatites	Hornblend-slate, &c.
Calciferous asbestinite,	Iron shot quartz,
Serpentine,	Earthy quartz, &c.

Appendix I.
Diamond.

Appendix II.

Genera.	Genera.
Lavas,	Pumice,
Enamels,	Zeolites,
Terras,	Traps,
Tufas,	and
Piperino,	Basalts.

Class II.—SALTS.

This class includes the orders Acid, Alkaline, Neutral; and, under each, the following genera:—

Order I. ACID.

Genera.	Genera.
Carbonic,	Phosphoric,
Vitriolic,	Arsenical,
Sulphureous,	Boracic,
Nitrous,	Molybdenous,
Muriatic,	Tungstenic.
Sparry,	Succinous.

Order II. ALKALINE.

Genera.	Genera.
Vegetable,	Volatile alcalies.
Mineral,	

Order III. NEUTRAL.

Genera.	Genera.
Tartar-vitriolate,	Nitrated magnesia,
Glauber's salt,	Salt of Sylvius,
Vitriol-ammoniac,	Common salt,
Epsom-salt,	Sal ammoniac,
Alum,	Muriated barytes,
Aluminous ores,	——— calx,
Vitriol of iron, copper, &c.	——— magnesia,
	——— argill,
Copper and zinc,	——— iron,
Nitre,	——— copper,
Nitrous ammoniac,	——— manganese,
Nitrated soda,	Borax,
——— calx,	Tincal.

Class III. INFLAMMABLES.

This class comprehends the orders Aërial, Bituminous, Carbonaceous, and Vegeto-bituminous, and under each the following genera:—

Order I. AERIAL.

Genera.	Genera.
Inflammable,	Hepatic.

Order II. BITUMINOUS.

Genera.	Genera.
Napththa,	Maltha,
Petiol,	Mineral tallow,
Mineral tar,	Mineral caoutchou.
Mineral pitch,	

Order III. CARBONACEOUS.

Genera.	Genera.
Coal,	Carbonated wood,
Plumbago,	Turf and peat.

Order IV VEGETO-BITUMINOUS.

Genera.	Genera.
Jet,	Copal,
Amber,	Honey-stone,
Ambergris,	Sulphur.

Class IV.—METALS.

This class comprehends the following metals under the three orders, Perfect, Imperfect, Semimetals.

Order I.	PERFECT.
Genera.	Genera.
Platinum,	Silver,
Gold,	Quicksilver.

Order II.	IMPERFECT.
Genera.	Genera.
Copper,	Lead,
Iron,	Tin.

Order III.	SEMIMETALS.
Genera.	Genera.
Zinc,	Uranite,
Antimony,	Tungstenite,
Arsenic,	Molybdænite,
Bismuth,	Sylvanite,
Cobalt,	Menachanite,
Nickel,	Titanite.
Manganese,	

Mr. Kirwan's works on mineralogy were long considered standard authorities; his Elements were translated into several languages, and his system was received with considerable applause even by the continental mineralogists. The clearness of his descriptions, and the accuracy of his experiments, entitle him to the warmest gratitude of the student; who may obtain much valuable information by a perusal of his works.

Although in this historical sketch we have rather endeavoured to present the reader with an account of mineralogical arrangements than of discoveries in the science of mineralogy, yet we must not omit to notice the celebrated Klaproth, whose works have perhaps contributed more to the chemical knowledge of minerals than those of any other writer. Were we to attempt to exhibit the chief merit of Klaproth, as a chemist, we should place it not so much in the discovery of new metals and earths as in the invention of a more exact and more perfect method of analysis than was previously attempted. The former kind of merit is more adapted to draw the attention of the public at large; but the latter is of infinitely greater consequence to science. We can here only notice the two principal methods of analysis with which he enriched the science of experimental chemistry.

The first of these was the complete resolution of the hardest minerals, by means of fluid caustic alkali, instead of the former treatment with dry caustic alkali, which had introduced the use of silver crucibles and saucers. The complete resolution of the hardest stones, by this method of analysis, has enabled us to ascertain, with extreme accuracy, the quantity of earths, oxides, metals, and even of acids, which minerals contain. Exact analyses of this kind remain sure for ever, and are of importance to the science, independently of any discoveries which may be made respecting the particular nature of the substances mentioned. As, for instance, the capability of being decomposed, which was afterwards discovered to belong to the earths, makes not one cypher incorrect or superfluous in such analysis. The advantage of this method is particularly evident in the decomposition of corundum or diamond-spar. As Klaproth first attempted the analysis of these bodies, by the old methods of decomposition, he found a considerable remainder of matter unaccounted for. On the suspicion, which he then expressed, that this remainder might perhaps be a new, and yet undiscovered earth, many compilers of school books were in a hurry to admit the earth of corundum into the list of the simple earths. But when Klaproth repeated the analysis, by means of the liquid alkali, he found that this substance was one of the many compositions of siliceous and argillaceous earths which had not previously been known, and which in former analyses had sometimes been referred to the one kind of earth, and at other times to the other. In the same manner, the chemists of England gave an account of a species of sand, which had been brought from New Holland, as a new earth; but Klaproth showed, by his new method of analysis, that this body also, which had already been introduced into introductory treatises, under the name of the Austral Earth, was nothing but an intimate mixture of siliceous and argillaceous earth. Indeed, the first analyses that can be considered as certain are those which have been undertaken on this plan. Hence, by this discovery, almost all the more early analyses have lost their value.

In the numerous exact analyses which Klaproth conducted according to this method, there was almost always discovered at last to be a small loss, that is to say, the weight of all the single component parts was ascertained to be somewhat less than the weight of the mineral which had been analysed. He in every case stated this loss with great precision, and by this undeviating regard to truth, obviously procured for the results of his labors a much greater certainty than if he had permitted himself, as he might easily have done, to conceal this loss under inconsiderable changes in the decimal figures. He also never gave his results, as he likewise easily might have done, in a great crowd of decimals, by which means the appearance of much exactness is sometimes gained, but he gave only as many cyphers as were pure. As long as the loss amounted only to a few thousand parts of the whole, it might easily be referred to those small mistakes which in every course of experiments are unavoidable, from the limited nature of our senses and instruments. But in some analyses, as for instance in that of Felspar, a loss of some hundred parts was discovered. Such a loss, considering the care with which Klaproth labored, could only arise from some of the constituent parts having entirely escaped observation during this method of resolution. Convinced that this could be neither an earth nor a metal, nor an acid, nor water, nor any other volatile matter, he at last began to suspect that perhaps many minerals might contain a hitherto unsuspected quantity of fixed alkali, which could not be discovered by the method of analyses by means of these alkalies. This consideration led to Klaproth's second great invention, viz. the method of analysis by means of Barytes, although, as was formerly remarked, the excellent Rose had a considerable part in this invention.

Having thus given as detailed a history as our limits would permit of the ancient systems, we proceed to

PART II.

AN ANALYSIS AND COMPARISON OF THE MODERN SYSTEMS OF MINERALOGY.

Of these, the first is that of the abbé Haüy, whose labors in CRYSTALLOGRAPHY have occupied our attention in that article. We have there given a succinct account of his Theory of the Structure of Crystals, to which we refer the reader. Several memoirs of Haüy on this subject were followed in 1801 by that celebrated professor's great work, entitled Traité de Mineralogie, in which his crystallographic theory is made subservient to the classification of minerals. He here defines the mineralogical species to be a collection of bodies whose integrant parts are alike, and composed of the same principles united in the same proportion. According to his idea of the subject, minerals have both a geometrical and chemical limit, the former consisting in the invariable form of the molecule, the latter in the composition of the same molecule. Haüy prefers making use of the geometrical limit for determining the species, not only because minerals being in general more or less mixed with heterogeneous matter, so often that the best chemical analysis is but imperfect, whereas mechanical division invariably furnishes the same form of the molecule, but principally because the geometrical limit is far more obvious and palpable, since to obtain it nothing more is often necessary than to divide the substance mechanically.

Notwithstanding the great reliance which M. Haüy places on the form of the integrant particle, he has remarked, in his Tableau Comparatif, that he does not consider a knowledge of the form of the integrant particle indispensable to the admission of a mineral to the rank of a distinct species, provided its composition be well ascertained, and found to be different from that of any known species. And it was under these circumstances that he first introduced the chromate of iron, as a distinct species. It appears that M. Haüy's first object in forming his system of crystallography was to unite different crystallised varieties of the same species about one common point, as a nucleus or primitive form; and he was thus almost necessarily led to form an arrangement of crystallised minerals only. But, however perfect this system may be in regard to the laws by which various secondary forms are derived from the same primitive form, it is not, even by its celebrated author, supposed equally competent to establish a mineralogical method. As therefore the character of the integrant molecule is not sufficient, the abbé adds to it another chemical or physical; thus, for instance, the property of dissolving in water superadded to the cubic form, determines muriate of soda (common salt); but, if the same form is united to the property of becoming electric by heat, we have borate of magnesia or common boracite.

The following is Haüy's distribution, taken principally from his Tableau Comparatif des Resultats de la Crystallographie, et de l'Analyse Chimique, Paris, 1809. The names in parentheses are those of the Wernerian school.

Class I.—ACIDIFEROUS SUBSTANCES.

Order 1.—*Disengaged acidiferous substances.*

1st. genus. Sulphuric acid.
2d. genus. Boracic acid.

Order II.—*Earthy acidiferous substances.*

A. with simple base :—
1st genus. Chaux (lime).
1, 3. Ch. carbonatée (comprising all the Wernerian species of carbonates of lime, with the exception of the following species).
4. Arragonite.
5. Ch. phosphatée (apatite).
6. Ch. fluatée (fluor).
7. Ch. sulfatée (gypsum and selenite).
8. Ch. anhydro-sulfatée (anhydrite).
9. Ch. nitratée.
10. Ch. arseniatée (arsenic bloom; pharmacolite, Klapr.)
2d genus. Baryte.
11. Baryte sulfatée (barytes or heavy spar).
12. B. carbonatée (witherite).
3d genus. Strontian.
13. S. sulfatée (celestine).
14. S. carbonatée (strontian).
4th genus. Magnesie.
15. M. sulfatée (natural Epsom or bitter salt).
16. M. boratée (boracite).
17. M. carbonatée (native magnesia or talc earth).
5th genus. Lime and silica.
18. Chaux boratée siliceuse (datholite).
6th genus. Silica and alumine.
19. Silice fluatée alumineuse (topaz and pycnite, or short beryl).

Order III.—*Acidiferous alkaline substances.*

1st genus. Potasse.
20. P. nitratée (natural nitre).
2d genus. Soude.
21. S. sulfatée (natural Glauber salt).
22. S. muriatée (rock-salt).
23. S. boratée (tinkal, K.)
24. S. carbonatée (natural soda or natron).
3d genus. Ammoniaque.
25. A. sulfatée (mascagnin, K.)
26. A. muriatée (natural sal ammoniac).

Order IV.—*Acidiferous alkaline earthy substances.*

27. Alumine sulfatée alcaline (alum).
Appendix.
28. Alumine fluatée alcaline (kryolite).
29. Glauberite.

Class II.—EARTHY SUBSTANCES.

(No subdivision into orders).

30. Quarz (the whole of Werner's quarz family, comprising fourteen of his species).
31. Zircon (zircon and hyacinth).
32. Corindon (corundum, sapphire, diamond, spar, emery).
33. Cymophane (chrysoberyl),
34. Spinelle (spinel, ceylanit).
35. Emeraude (emerald, beryl).
36. Euclase

37. Grenat (garnet, melanite).
38. Amphigene (leucite).
39. Idocrase (Vesuvian).
40. Meïonite.
41. Feld-spath (feldspar).
42. Apophyllite (fish-eye stone or ichthyophthalmite).
43. Triphane (spodumen).
44. Axinite.
45. Tourmaline (shorl).
46. Amphibole (all the sub-species of hornblende, except Labrador hornblende, actinote, augite, and tremolite partly.
47. Pyroxène (augite, sahlite).
48. Yenite.
49. Staurotide (staurolite).
50. Epidote (pistazite, zoisit).
51. Hypersthène (Labrador hornblende).
52. Wernerite (arktizit).
53. Paranthine (scapolite).
54. Diallage (variety of arctinote, schillerstein).
55. Gadolinite.
56. Lazulite (azur-stone).
57. Mesotype fibrous and mealy zeolite, nadelstein.
58. Stilbite (radiated and foliated zeolite).
59. Laumonite (lomonit).
60. Prehnite.
61. Chabasie (schabasit).
62. Analcime (kubizit).
63. Nepheline (nephelin; sommit K.)
64. Harmotome (cross-stone).
65. Peridot (chrysolite, olivine).
66. Mica (glimmer or mica).
67. Pinite.
68. Disthène (cyanite).
69. Dipyre (schmelz-stein; dipyr, K.)
70. Asbeste.
71. Talc.
72. Marle (hollow spar; chiastolite, K.)

To this class are appended the following substances, the characters of which are not sufficiently well understood to assign them their respective places in the system:—

Allochroite (splintery garnet, K.)
Alumine, pure (pure clay).
Amianthoïde.
Antophillit, Schum. and Wern.
Aplome.
Bergmannit, Schum.
Diaspore.
Feldspath apyre, H. (andalusit).
Feldspath bleu (variety of compact feldspar).
Fibrolite, Bourn.
Gabbronite, Schum.
Jade (common nephrite, axe-stone).
Jolithe, W. and K.
Kaneel or cinnamon stone, W.
Lazuli, W.
Latialite (hauyne).
Lepidolite, W.
Melilite, Fleuriau.
Natrolite, W.
Pseudo-sommit; Fleur de B.
Spath en tables (schaalstein).
Spinellane.
Spinelle zincifère? (automalite).
Spinthère, H.
Talc? granuleux (earthy talc), and
T. glaphique (bildstein; agalmatolite, K.)

Class III.—COMBUSTIBLE NOT METALLIC SUBSTANCES.

Order 1.—*Simple.*

73. Soufre (sulphur).
74. Diamant (diamond).
75. Anthracite (kohlenblende, glanz-kohle).

Order II.—*Compounds.*

76. Graphite.
77. Bitume (mineral oil; mineral pitch).
78. Houille (black coal).
79. Jayet (pitch coal).
80. Succin (amber).
81. Mellite (honey-stone).

Class IV.—METALLIC SUBSTANCES.

Order 1.—*Not immediately oxidable except by a very high degree of heat, and immediately reducible.*

1st genus. Platina.
82. P. natif ferrifère (native platina).
2d. genus.
83. O. natif. (native gold).
3d. genus. Argent.
84. A. natif (native silver).
85. A. antimonial (antimonial silver); as appendix to it,
A. antimonial ferro-arsénifère (arsenical silver).
86. A. sulfuré (vitreous silver-ore).
87. A. antimonié sulfuré (red-silver-ore); and, as appendix to it,
A. antimonié sulfuré noir (brittle vitreous silver).
88. A. carbonaté.
89. A. muriaté (horn-ore or horn-silver).

Order II.—*Immediately oxidable and reducible: Mercure.*

90. M. natif (native mercury).
91. M. argental (native amalgam).
92. M. sulphuré (cinnabar); and, as appendix,
Mercure sulfuré bituminifère (mercurial liver-ore).
93. Mercure muriaté (mercurial horn-ore).

Order III.—*Oxidable, but not immediately reducible.*

a, sensibly ductile.
1st genus. Plomb.
94. P. natif volcanique.
95. P. sulfuré (galena); by way of appendix,
P. sulf. antimonifère, and
P. sulf. antimonifère et argentifère (weissgultig-erz).
96. P. oxydé rouge.
97. P. arseniaté (flokken-erz, K).
98. P. chromaté (red lead-ore).
99. P. carbonaté (white lead-ore); and, as appendix,
P. carb. noir (black lead-ore, lead earth; and
P. carb. cuprifère.
100. P. phosphaté (brown and green lead-ore).
101. P. molybdaté (yellow lead-ore).
102. P. sulfaté (natural lead vitriol).
2d genus. Nickel.

103. N. natif (capillary iron pyrites).
104. N. arsenical (copper nickel).
105. N. oxydé (nickle ochre).
3d genus. Cuivre.
106. C. natif (native copper).
107. C. pyriteux (copper pyrites); and, as appendix,
C. pyr. hépatique (variegated copper-ore).
108. C. gris (gray copper ore).
109. C. sulfuré (vitreous copper ore).
110. C. oxydulé (red copper ore and tile ore).
111. C. muriaté (saltz-kupfer).
112. C. carbonaté bleu (copper azur).
113. C. carb. vert (malachite; copper green).
114. C. arseniaté (lenticular copper ore; olive ore); as appendix,
C. arsen. ferrifère (cupreous arseniate of iron, Bourn).
115. C. dioptase (copper emerald).
116. C. phosphaté.
117. C. sulfaté (copper vitriol, K).
4th genus. Fer.
118. Fer natif (native iron).
119. F. oxydulé (magnetic iron stone); and, by way of appendix,
F. oxydulé granuliforme (iron-sand).
120. F. oligiste (specular iron, iron mica, red iron froth, red hematite; compact red iron-stone, columnar clay iron-stone).
121. F. arsenical (common arsenical pyrites); and, as appendix,
F. arsenical argentifere (weiss-ertz, W. noble arsenical pyrites, K).
122. F. sulfuré (common pyrites); and, as appendix,
F. sulfuré épigène (leberkies, but not of Werner), and
F. sulfuré ferrifere (magnetical pyrites).
123. F. oxydé (brown hæmatite; reniform and lenticular clay iron-stone; green iron-earth); and, as appendix,
F. oxydé résinite (eisenpech-erz, or pitchy iron-ore); also part of F. oxydé carbonaté (sparry iron-stone).
124. F. phosphaté (blue iron earth).
125. F. chromaté (eisen-chrom, K.)
126. F. arseniaté (cube ore).
127. F. sulfaté (native vitriol).
5th genus. Etain.
128. E. oxydé (tin-stone); and, as appendix,
E. oxydé concrétionné (Cornish tin ore, or wood tin).
129. E. sulfuré (tin pyrites).
6th genus. Zinc.
130. Z. oxydé (calamine).
131. Z. carbonaté.
132. Z. sulfuré (blende).
133. Z. sulfaté (zinc vitriol, K).
b, not ductile.
7th genus. Bismuth.
134. B. natif (native bismuth).
135. B. sulfuré (bismuth glance); and, as appendix,
B. sulf. plumbo-cuprifère (needle ore).
136. B. oxidé (bismuth ochre).
8th genus. Cobalt.
137. C. arsenical (white and gray cobalt-ore).
138. C. gris (cobalt glance).
139. C. oxidé noir (black cobalt ochre).
140. C. arseniaté (red cobalt ochre).
9th genus. Arsenic.
141. A. natif (native arsenic).
142. A oxidé (arsenic bloom).
143. A. sulfuré (yellow and red orpiment).
10th genus. Manganèse.
144. M. oxidé (gray and black manganese ore); and, as appendix,
M. oxidé carbonaté (red manganese ore).
145. M. sulfuré (manganese glance, K).
146. M. phosphaté ferrifère (phosphor. mangan, K).
11th genus. Antimony.
147. A. natif. (native antimony).
148. A. sulfuré (gray antimony ore).[1]
149. A. oxidé (white antimony ore; antimony ochre).
150. A. oxidé sulfuré (red antimony ore).
12th genus. Uran.
151. U. oxidulé (pitch ore).
152. U. oxidé (uran mica; uran ochre).
13th genus. Molybdena.
153. M. sulfuré (molybdena).
14th genus. Titahe.
154. T. oxidé (rutil; menakan).
155. T. anatase (octaedrit).
156. T. siliceo-calcaire (sphen).
15th genus. Scheelin.
157. S. ferruginé (wolfram).
158. S. calcaire (tungsten).
16th genus. Tellure.
159. T. natif; auro-ferrifèré (native sylvan), argentifère (graphic ore); auro-plombifère (nagyag ore.)
17th genus. Tantale.
160. T. oxidé ferro-manganésifère (tantalit, K). and ytirifère (yttro-tantalite, K).
18th genus. Cerium.
161. C. oxidé silicifère (cererit, K).

The abbé Haüy's works are the first in which a truly scientific exposition of crystallography is to be found; but, by designating most of the forms by separate names, he has presented them to the mind rather as independent individuals than as parts of such groups as should render their relations to each other, and hence their mineralogical relations, apparent. One of his sources of error may be discovered in an apparently groundless notion that nature has imposed limits to the angles at which the primary planes of crystals incline to each other. And some of the mistakes which originate from this supposition are so important as to cast a shade of doubt over his determinations relative to the primary forms of crystals. His inaccuracy with respect to the angle of carbonate of lime is a well known example of one of these theoretic errors. And, by assigning to the magnesian and ferriferous carbonates of lime the same angle as to the simple carbonate, the error became still greater. His inaccurate measurements of many of the angles of crystals have probably been occasioned by the comparatively imperfect instrument with which they were taken. That he should conti-

nue to prefer this to the more perfect goniometer invented by Dr. Wollaston may possibly have been owing to the decay of sight incident to that period of his life when he first entered into these investigations, and to that dislike to change which is frequent in old age. Although the measurements above quoted have been since repeatedly verified by experiment, the abbé not only continued to insist on the superior accuracy of his own measurements, but discusses, through several pages, how it could have happened that the iron should have displaced the lime in the crystals of carbonate of iron, which his original error led him to regard as pseudomorphous. With all the inaccuracies, however, which his works contain, they present to the reader truly philosophical views of the sciences of which they treat, and cannot be perused without affording considerable gratification and improvement.

The labors of M. C. S. Weiss, formerly professor of mineralogy at Leipzic, and now we believe in the university of Berlin, have greatly contributed to the advancement of mineralogical and crystallographic knowledge. His first paper, which contains some valuable remarks on the different axes of the primitive forms, was published in 1815, and is entitled Des Divisions Naturelles des Systemes de Cristallization. In 1817 a memoir of his appeared in the Transactions of the Academy of Berlin, explaining his method of describing all the crystalline faces of any system whatever, in relation to the fundamental axes of the system, which is, however, too elaborate for us to detail.

We must now proceed to the consideration of the most celebrated of the modern systems of mineralogy, viz. that of professor Mohs, of Freiburg, which has been followed by Jameson of Edinburgh, and, indeed, by most of the mineralogists of the present day. A pupil of the celebrated professor has, in the third volume of the Edinburgh Philosophical Transactions, given the most concise and lucid exposition of the principles upon which his crystallographic and mineralogical systems are founded, that has yet appeared in this language. We could wish that our limits would allow us to give it entire; but, as this is not the case, we shall endeavour to present the reader with an abridgment of his principal remarks.

The following problem is presented as an example of the method in which the simple forms are discovered to be combined in the compound ores. Let fig. 1. Plate I., MINERALOGY, represent a crystallisation of calcareous spar. The form is a compound one, and all the faces of the same description belong to the same simple form contained in it. The junction of those simple forms is symmetrical, because it possesses the highest degree of regularity which their nature and position can permit. The symmetry in this case is expressed by the parallelism of the several edges of combination; and the general problem of crystallography is here transformed into the special one, of finding the circumstances under which the edges of combination obtain their parallelism. If in any combination the homologous faces (the faces agreeing in figure and position) are enlarged, till, all the rest having disappeared, they alone bound the whole solid on every side, the simple forms which the combination included, will successively appear. By this operation, from the faces *g*, P, *f*, *m*, *b*, of fig. 2, we obtain five rhomboids (figs. 3, 4, 5, 6); and from the planes *x*, *y*, *a*, three scalene six-sided pyramids,—pyramids consisting of scalene triangles, as in fig. 10.

The rhomboids have a particular arrangement in the combination, viewed in the distribution presented by this example, the edges of any rhomboid; and the oblique diagonals drawn upon the faces of the one which follows it, lie in the same vertical plane. Such combinations as do not include an uneven number of rhomboids are arranged so that the edges of one rhomboid lie in the same vertical plane with the edges of the next, and the diagonals of the one with the diagonals of the next. In figs. 3, 4, 5, 6, and 10, this arrangement is observable.

If the faces of any two rhomboids, which stand contiguous in the above-mentioned order, *g* and P for instance, or P and *f*, or *f* and *m*, or *m* and *b*, of fig. 2, are simultaneously enlarged, till all the other faces disappear, and the faces of this pair include the whole solid; a form results, which is a combination of those rhomboids, and the edges of combination made by its faces with each other are parallel, as in fig. 1. This parallelism evidently arises from the dimensions of the rhomboids, in other words, from the magnitude of their angles, because it disappears whenever the dimensions of the one or the other are changed. The foregoing problem, therefore, requires to find the ratio of the dimensions by which the edges of combination are rendered parallel.

Solution.—Place a rhomboid in such a position that the straight line passing through two corners (solid angles) formed by equal plane angles, may be vertical. Those corners are named the summits that line the axis. In this position the rhomboid stands upright. Rhomboids, therefore, stand upright when their axes are perpendicular. From those solid angles of a rhomboid, which are not summits, let fall perpendiculars upon a horizontal plane, and connect the points where they meet the plane by straight lines. The figure which results will be a regular hexagon; it is called the horizontal projection of the rhomboid.

Derivation of a more obtuse rhomboid.—Bring a rhomboid into the upright position; and through those edges which meet in the extremity of the axis, stretch planes equally inclined to the faces of the rhomboid. Extend these planes till they all intersect each other: the solid bounded by them will in its turn be a rhomboid. Figs. 4 and 5, fig. 5 the original, fig. 4 the derived with the original. The axis of this new rhomboid is equal to that of the preceding. The horizontal projection is equal in area to four times, in periphery to twice, the horizontal projection of the latter. Together they produce parallel edges of combination. This new rhomboid has a position different from that of the

first. The edges of the former have a similar situation with the oblique diagonals of the latter; that is to say, they lie in the same vertical plane with those diagonals. If sections are drawn parallel to the faces of the new rhomboid, and lying nearer the axis or middle point, those sections will truncate the edges of the original rhomboid: from which will arise the form of a combination of two rhomboids, having the edges of combination parallel.

To give the foregoing proportions a more convenient expression, suppose the horizontal projections of the rhomboids, or the sides of those projections, to be equal, the axis of the new rhomboid will then become equal to half the axis of the original rhomboid. It follows that, if two rhomboids produce parallel edges of combination with each other, the axis of the one must be half that of the other, the horizontal projections being equal. This is merely the proportion between the two rhomboids, expressed by their axes, on the supposition of equal horizontal projections. The absolute dimensions of the rhomboids must be such that both together may be capable of contributing to bound the solid.

On each of the obtuse rhomboids formed by the foregoing process the same process may be again repeated. A new rhomboid in its turn will result, whose axis, if the axis of the horizontal projections are equal, being half the rhomboid immediately preceding, will consequently be fitted to produce parallel edges of combination with it.

Inversion of the process.—The process may be inverted. Draw the diagonals; through every two oblique and one horizontal diagonal extend cutting planes, and deduct the portions which lie without them. The remainder, the part enclosed within the cutting planes, will likewise be a rhomboid. The axes of both these rhomboids are equal. The horizontal projection of the new rhomboid is the fourth part of the horizontal projection belonging to the original rhomboid; the sides of the former are equal to half those of the latter; and consequently, when the horizontal projections are considered equal, the axis of the secondary will be double that of the original rhomboid. This process may be continued indefinitely; and, of all the rhomboids that result from it, any two following in immediate succession will always exhibit such mutual proportions as to produce parallel edges of combination with each other.

All those rhomboids which are produced by the above operations are consequently subject to the general law, that, their horizontal projection being equal, their axes must increase or diminish as the powers of the number 2. These axes, therefore, follow each other in a geometrical progression, and the rhomboids constitute a series which may be developed out of any given member, and expanded indefinitely on both sides.

Designation of the series.—Let the fundamental rhomboid be designated by r; the next more acute one, obtained from the second process, by $r+1$, so that this expression may point out the rhomboid's place, or its distance from r; the next more obtuse one, obtained from the first process, by $r-1$, so that by this means the distance or the position, with regard to r, may in like manner be expressed; and the rest in a similar mode; then, if the axis of r is put $=1$, the first of the three following lines will represent the series of rhomboids, the second their axis, and the third those powers of 2 by which they are expressed.

$$\begin{array}{ccccccccc} -- & r-3\,. & r-2\,. & r-1\,. & r\,. & r+1\,. & r+2\,. & r+3 & -- \\ & \tfrac{1}{8}\,. & \tfrac{1}{4}\,. & \tfrac{1}{2}\,. & 1. & 2\,. & 4\,. & 8\,. & \\ & 2^{-3}. & 2^{-2}. & 2^{-1}. & 2^{-0}. & 2^{1}. & 2^{2}. & 2^{3}. & \end{array}$$

These progressions may be prolonged on both sides as far as we please. The horizontal projections being equal, the axes by this means perpetually augment on the one hand, and perpetually diminish on the other. If they become infinitely small, the rhomboids are converted into regular six-sided prisms, the one of which has an axis infinitely great, the other an axis infinitely small. These prisms are named the limits to the series of rhomboids; their designation is $r \pm \infty$: and hence within its limits the series is—

$$r-\infty \text{-----} r-1\,.\,r.\;r+1 \text{-----} r+\infty$$

Base of the regular six-sided prism.	Rhomboid whose axis $=1$.	Unlimited regular six-sided prism.

Forms of infinite dimensions are not exhibited by nature. The limits appear, therefore, only in combinations. The completed regular six-sided prism, as displayed in nature, is a combination of both limiting forms.

Nature confirms the law of this rhomboidal series within its limits in all minerals that assume such forms. In calcareous spar, of which all the figures in plate I. are varieties, let P, fig. 5, be represented by r; that is to say, by the rhomboid which constitutes the basis of derivation, and whose axis has been put $=1$; then is $g=r-1$, fig. 4; $f=r+1$, fig. 6; $m=r+2$, fig. 3. All these rhomboids have pretty exactly the dimensions which they would have if calculated according to the foregoing proportions, from the rhomboid P, estimated $=104°\ 28'$. If, in place of that number, we employ $105°\ 5'$, the result of numerous measurements instituted for this purpose, the dimensions of the derived rhomboids, calculated upon this supposition agree still more exactly with nature. c, fig. 7, is $=r+\infty$.

In different minerals, particularly in calcareous spar, several rhomboids appear which are not included in the preceding series. They still, however, follow the same general law. The terms of the accompanying series are capable of being found by a deduction similar to that used in the principal series; but the narrowness of our limits will not allow us to exemplify this method.

Isosceles six-sided pyramids.—Suppose fig. 8 to represent a crystalline form proceeding from iron-glance. If the faces P are enlarged till they comprehend the entire solid, the figure will be changed into a rhomboid. If the faces s are enlarged till they likewise completely include the whole solid, we obtain an isosceles six-sided pyramid, fig. 9. The faces of the pyramid, uniting with those of the rhomboid, produce parallel edges of combination. The particular relation

of the pyramid to the rhomboid, upon which this parallelism depends, is, that the horizontal projections being equal, the axis of the pyramid is to that of the rhomboid as $\frac{3}{4}$ to 1.

On rhomboids of infinitely great or infinitely small axes, there depend, in like manner, isosceles six-sided pyramids of infinitely great or infinitely small axes. They also are regular six-sided prisms, distinguished from the preceding by their different position in combinations. These prisms constitute, moreover, the limits of the isosceles six-sided pyramids.

Di-rhomboid.—Bisect those edges of the rhomboid which do not meet the axis. Connect the points of bisection and the summits of the rhomboid by straight lines, and through these lines extend cutting-planes which may take away from the rhomboid segments, such as *f*, *k*, *l*, fig. 12. The remainder will be an isosceles six-sided pyramid, represented in fig. 9. This pyramid must not be confounded with the preceding, because it has not the same proportions to the rhomboid, from which it originates. If we suppose that a rhomboid, as fig. 12, combines with itself in a position different by 60°, the pyramid will, in like manner, originate from this union. The figure, in consequence of its origin, is therefore not a simple form; but, as it manifests in all respects the same relations as the simple rhomboid, it will henceforth be named a di-rhomboid.

Let any rhomboid be placed in an upright position. Produce the axis, to any distance, equally on both sides of the summits. From the corners of the rhomboid draw straight lines to the extremities of the produced axis, through every contiguous pair of those lines, and the intermediate edge of the rhomboid; let planes be extended; the solid which those planes include will be a scalene six-sided pyramid, fig. 10. In this pyramid the edges which do not meet at the summit occupy the same position as the corresponding edges of the rhomboid; they are hence named rhomboidal edges; the others pyramidal or axis edges. Of a scalene six-sided pyramid, whose rhomboidal edges agree in situation with the same edges of a rhomboid, we say that it is derived from the rhomboid, or depends upon it.

Nature presents no scalene-pyramids, but such as are capable of uniting among themselves, or with other forms derived from the rhomboid, to produce symmetrical combinations. We obtain pyramids of this sort, if the axis of the rhomboid from which they are derived (32) is in the first place doubled, in the second tripled, and in the third place quintupled. A pyramid obtained by doubling the axis is called a primary, by tripling it a secondary, and by quintupling it a ternary pyramid. Primary pyramids of this species are designated by $(p \pm n)'$; secondary pyramids by $(p \pm n)''$; ternary by $(p + n)'''$; so that the primary pyramid depending on r would be marked $(p)'$; the secondary $(p)''$; the ternary $(p)'''$; the primary pyramid depending on $r + 2$ would be marked $(p + 2)'$; the secondary $(p + 2)''$; the ternary $(p + 2)'''$.

The regular six-sided prism has already been considered as a rhomboid with an axis infinitely great. The question now arises, what will be the condition of a primary, secondary, or ternary pyramid, originating from a rhomboid with an axis infinitely great? Draw two sections perpendicular to the axis of a pyramid, and so as to pass through the extreme points of the rhomboidal edges. The surfaces of these sections will be irregular hexagons, whose angles have a fixed relation to those of the transverse section. Examine now that segment of the pyramid comprised between the two sections just drawn. Its length, or altitude, is one-third of the axis of that rhomboid from which the pyramid is derived. Hence, if the rhomboid's axis be infinite, the altitude of this segment must likewise be infinite.

Besides those two faces, which are perpendicular to the axis, this segment is bounded by twelve scalene triangles. In proportion as the ratio of the rhomboid's axis to the side of its horizontal projection augments, so much the nearer will two of the angles in each triangle approach to 180°,—the third to 0°; and when the rhomboid's axis, in comparison with the side of its horizontal projection, becomes infinite, and the rhomboid thus changes into a regular six-sided prism, then the bounds are reached, the triangles become unlimited parallelograms, and the middle segment of the pyramid becomes an unlimited irregular twelve-sided prism. This prism will have for its base the transverse section of the primary pyramid, if the middle segment in question belongs to a primary pyramid; the transverse section of the secondary, when that segment belongs to a secondary pyramid; and the transverse section of a ternary, when to a ternary pyramid. The rhomboid, with its axis infinitely great, that is to say, the regular six-sided prism constituting the limit of the rhomboidal series, has thus dependent on it three scalene six-sided pyramids, also with axes infinitely great, of which one is a primary, the next a secondary, the last a ternary; and which, therefore, assume the appearance of irregular twelve-sided prisms, each dependent on its appropriate transverse section. These prisms are the limits of the scalene six-sided pyramids. It is observable that the regular six-sided prisms, which form the limits of the isosceles pyramids, have no twelve-sided prisms of this sort: hence these prisms appear in combinations, only in one and the same position. These prisms which, like all forms having one of their dimensions unlimited, can only appear in combinations, are exemplified by nature, in tourmaline, in emerald; some of their faces are found even in calcareous spar. In tourmaline, the prism, which depends on the secondary pyramid, is designated by *h*; the general expression for these prisms is $(p \pm \infty)^m$, where m, as above, signifies the characters $'$, $''$, $'''$.

On glancing back over the ground we have passed, one is astonished at the multitude and variety of forms which may be deduced from a given rhomboid, and submitted to very simple laws; yet the whole compass of this subject is still far from exhausted, and many remarkable phenomena relating to it have been omitted for want of room. Nature combines these forms in crystalline figures. From their dependence upon each other, and from the proportions in which

...ly stand, we may comprehend that ...nations must possess the highest ...ity admitted by their simple ... be completely symmetrical. ...f the enquiry nothing is ...ing a palpable represen... ...han to study the crys... ...ar; and nothing for ...but that study than ...e proportions are on ...d that symmetry.

...s, with square bases.—Be... ...eady noticed, no other can ... the rhomboid. Hence, no ...le of entering into combination ...omboid, or with any form derived ...f, however, we take a four-sided pyramid having a square base, fig. 13, and treat it ...escribed, we shall obtain a series of four-...ded pyramids with square bases, which will proceed according to the powers of $\sqrt{2}$, and whose limits will be rectangular four-sided prisms. As the horizontal projections of two consecutive pyramids are not parallel to each other, these prisms must be regarded as in two different positions.

Nature demonstrates the existence of this series within its limits, in the case of zircon, tungsten, vesuvian, tinstone, yellow-lead, uran-mica, rutule, anatase, and others. Upon this series depends also an accompanying series of four-sided pyramids, with square bases; its coefficient is $\frac{3}{2\sqrt{2}}$.

Scalene eight-sided pyramid.—Three pyramids of this kind depend upon each four-sided one with a square base, in the principal series; and the axes of the former are to those of the latter as 3 : 1, 4 : 1, 5 : 1. In the order here assigned to them, like the six-sided pyramids formerly mentioned, they are named the primary, secondary, and ternary. The manner in which these eight-sided pyramids originate from the four-sided pyramids cannot, however, be here detailed for want of room. The limits which bound this single series of eight-sided pyramids are eight-sided prisms, having the same unequal angles as the transverse section of the pyramid to which they belong. Since the horizontal projections of two consecutive four-sided square-based pyramids occupy different places, these prisms must be considered as having two different positions.

Nature displays the existence and the limits of this series of eight-sided pyramids in the following examples. In zircon, fig. 13 and 14, let P be $= p$; then is $x = (p)'$, that is to say, the simple form that arises from augmenting the faces, *f*, is the primary scalene eight-sided pyramid, originating from the four-sided square-based one, designated by P; and the axis of the former is consequently equal to three times that of the latter. In this same mineral are likewise found $(p)''$ and $(p)'''$; as the Institute's collection exemplifies. Whatever was above established, respecting those forms which originate in rhomboids, may also be applied to those forms which originated in four-sided square-based pyramids, The remarkable analogy which exists in all points between the one class and the other, contributes not a little to augment the interest arising from the study of both. The latter, like the former, constitute among themselves a group, and produce symmetrical combinations, into which they admit nothing that cannot be derived from the fundamental form, in the mode already explained.

Four-sided pyramids with oblique bases.—A similar group will result, if, with some very slight alterations, we apply the process of derivation, explained above, to a four-sided pyramid with an oblique base. From that operation several series of four-sided oblique-based pyramids arise; in some of which the transverse section at right angles to the axis is similar to the transverse section of the original pyramid; in others not. The limits of these series are oblique-angled four-sided prisms, whose axis, if the pyramid is in its upright position, are vertical. By this derivation, however, we also obtain prisms whose axes (the fundamental oblique-based four-sided prism being in its upright position) lie horizontally, and are parallel to the diagonals of the oblique base. From the union of two horizontal prisms, a form results which some crystallographers have named a four-sided pyramid, with a longish rectangular base.

Hexahedron, and the forms that result from it.—A multitude of forms yet remain which are not connected with any of the preceding. Such are those that possess the greatest, sometimes even a geometrical regularity in their simple forms, and the highest degree of symmetry in their combinations. They can all be derived from the hexahedron (cube), by placing it upright, and considering the position of a moveable plane with regard to its faces and edges. Forms of this sort, never assuming infinite directions, have no limit like the preceding. Some of them, however, have constant dimensions, while the dimensions of others are variable. The former may be viewed as limits of the latter. Every simple form, from which other simple forms are derived, is called a fundamental form; and the class of figures derived from that fundamental form, a system of crystallisations. Hence, in the mineral kingdom, there are four fundamental forms, and four systems of crystallisations. The rhombohedral; the pyramidal, derived from a four-sided isosceles pyramid; the prismatic, derived from a scalene four-sided pyramid; and, lastly, the tessular, or that which is derived from the hexahedron.

Three of our fundamental forms are indeterminate in their dimensions; the fourth, the hexahedron, is constant in its dimensions. The dimensions of all derived forms depend upon those of the fundamental forms, the variations of which they follow to their limits, in the rhomboidal and pyramidal systems: and in the prismatic system, to the rectangular four-sided prism, which remains always the same, how different soever the dimensions of the fundamental forms may become. In any of these three systems, if the dimensions of the fundamental form are determined, we obtain from it, by derivation, a train of forms having determinate dimensions, among which the general proportions of the

system are observed. Whenever the dimensions of the fundamental form are altered, the dimensions of all such forms as result from it are altered likewise, without, however, changing the mutual ratios which they bear to each other.

The different series of crystallisations are of the highest importance for properly determining the species of minerals, the systems of crystallisations for determining their characteristics. And, as all minerals do not present themselves in a crystallised state, the cleavage comes forward to compensate for the absence of crystallisation; because any form of cleavage, not a limiting form, represents some member in the series of crystallisations belonging to that species. A limiting form, however, determines the system of crystallisations, provided it be not a straight four-sided rectangular prism, in which case the choice, lying between the pyramidal, prismatic, and tessular systems, must be determined by the circumstances.

When any cleavage form is a straight rectangular four-sided prism, though from any other quarter the smallest hint were not given us by which the particular system of crystallisations it belongs to could be determined, the following simple considerations will be sufficient to fix that point:—A straight four-sided prism presented to us may be 1. The hexahedron. 2. The limits of the pyramidal system. 3. A combination of the limiting forms of the prismatic system. If the faces of the cleavage, in regard to their completeness and lustre, are each of a different nature, the form comes under the first case. If two faces of the cleavage are of the same, the third of a different nature, then the form must come under the third case. Examine the cleavage in the direction of the diagonal. If this, once more, affords a rectangular four-sided prism, it indicates the pyramidal system; if it affords an oblique angular four-sided prism, it indicates the prismatic system. When all the cleavage faces are of the same nature, the form may come under any of the whole three cases. Between the second and the third a decision must be made as above. If the additional cleavage produces a rectangular four-sided prism, seek to obtain the same figure in the direction of another axis. If we obtain it, the form is a hexahedron; if we cannot obtain it, the form is the limit of the pyramidal system.

It is well known how far our judgments of cleavage and cleavage-forms are rendered easy and certain by a little practice. To such a degree is this the case, that an observer can often, with great facility, determine the form in minerals, which, but for this simple artifice, would scarcely have exhibited to us any traces of regular conformation. All these and similar advantages assist us in applying the system of crystallisations to the purpose of determining minerals. But, notwithstanding the universality of its application, nothing can be accomplished by means of it alone. To render it effectual, some other characteristics must be combined with it. Specific gravity, hardness, and lustre are the most important of these characters.

The remarks on mineralogical nomenclature in this sketch are, however, too important to be omitted.

The word with which we designate a single object, remarks our author, is called a name. This object may be such as to include a number of others. If the name has an epithet annexed, it is called a denomination. This denomination no longer designates that object on which the name was bestowed, but some single object included under it; and this last may, in its turn, include other objects. This distinction between names and denominations will afterwards be useful on account of brevity.

By names alone no mutual relation of the things which bear them can ever be expressed. A denomination effects this; the name, by its annexed epithet, marking a stricter designation. Hence, in a systematic nomenclature, the species bear denominations not names.

To give the name a more definite signification in the case of the species, it is applied to the genus, or the order, or some of the higher steps of classification. The name refers not to one single production of nature, or to one species, but to a class of greater extent; it reaches to the former only in so far as their characters entitle them to a place under that class. It is by this arrangement that the systematic nomenclature is enabled to restrict the arbitrary application of names. A newly discovered mineral, though not belonging to any known species, would probably belong to some known genus, and therefore obtain the name of that genus, or to some known order, and hence take its name from that order.

The names M. Mohs has employed are, pyrites, ore, glance, spar, &c. The term pyrites has already been applied to certain minerals belonging to one order; it is, therefore, employed to denote an order. Some other substances, which likewise belong to that order, have therefore necessarily received this designation, and laid aside their previous names,—nickel, for example, glance-cobalt, and others. The signification of the order settles what is or is not pyrites; and whatever, according to that signification, is pyrites,—in other words, whatever belongs to the order bearing this name, must also be called pyrites. The same kind of management has been followed with the other names, as may be seen by inspecting the mineralogical system, to which the new nomenclature is applied.

Next to the name, the most important point is the first restriction of it, that adjunct, to-wit, by which the name of an order is transformed into the name of a genus. The generic name ought to be founded on the natural historical nature of the genus. Of this kind are garnet-blend, ruby-blend, glance-blend. These three genera all belong to the order of blends. The first, however, has the appearance of garnet; the second, at least in some varieties, of ruby; the third of glance. This mode of forming the generic name would, doubtless, be the most advantageous, because it leads to no delineations which are foreign to natural history. It cannot, however, be universally applied, without introducing a multitude of new names; and hence, in conformity to the previous rule, with the sacrifice of uniformity it is true, two other means have been attempted. The first is to make use of some customary trivial names for settling the genera; the other to apply to this an arrangement not

properly arising from natural history. On the former principle are felspar, augite-spar, azure-spar, on the latter, iron-pyrites, cobalt-pyrites, lead-glance, molybdenum-glance, and others. No doubt, the second class of names have a chemical sound; but they have no chemical meaning; and all depends upon the meaning. Of a similar, yet not altogether identical nature, are fluor-haloid, calcareous-haloid, gypsum-haloid; but not less exceptionable in that respect.

The farther restriction of the generic names into specific ones is brought about simply by means of an adjective, indicating the systems of crystallisations, or some relation of the cleavage, or in general that character by which the species of a genus are most advantageously distinguished. Such are hexahedral, prismatic, rhomboidal, iron-pyrites; rhomboidal, octahedral, prismatic corundum; octahedral, rhomboidal, prismatic iron ore, and many others. When the forms of two species in a genus belong to the same system of crystallisations, the same process is followed; to the one adjective is joined another, by which the nature of the cleavage is more accurately denoted. This has been done in cases such as rhomboidal and prismato-pyramidal titanium ore and the like. In these instances no idea must be entertained of the transposition or mingling of two systems of crystallisations. In the first example the denomination merely signifies, that the form of the species belongs to the rhomboidal system, and that the cleavages, on the other hand, takes place according to prisms which can be no other than regular six-sided prisms. In the second example the denomination indicates, that the forms belong to the pyramidal system, and that the cleavage takes place according to prisms which must, therefore, be rectangular four-sided prisms. When the system of crystallisation and the cleavages of two or more species agree, as in several calcareous haloids, augite-spars, and others, a particular property of the crystallisations, &c., is chosen to form the special denomination; such as long or short-axed, right or oblique angled, and so on. The term axifrangible, or axis-cleaving, denotes a particular direction of cleavage perpendicular to the axis, as in axifrangible zeolite; prismatoidal denotes one particular direction of cleavage, parallel to the axis, as in prismatoidal antimony-glance.

Professor Mohs has arranged the mineral kingdom under three classes.

Class I.

If solid; sapid. No bituminous odor. Sp. gr. under 3·8. It has four orders.

Order I.—Gas.

Expansible. Not acid.

Order II.—Water.

Liquid. Without odor or sapidity. Sp. gr. 1

Order III.—Acid.

Acid. Sp. gr. 0·0015 to 3·7.

Order IV.—Salt.

Not acid. Sp. gr. 1·2 to 2·9.

Class II.

Insipid. Sp. gr. above 1·8.

Order I.—Haloide (salt-like).

Not metallic. Streak uncolored.

If pyramidal or prismatic; H. hardness, = 4 and less. If tessular, H. = 4·0. If single, perfect, and eminent faces of cleavage; sp. gr. = 2·4 and less.

H. = 1·5 to 5·0. If under 2·5, sp. gr. = 2·4 and less. Sp. gr. = 2·2 to 3·3. If 2·4 and less, H. under 2·5; and no resinous lustre.

Order II.—Baryte.

Not metallic. If adamantine or imperfect metallic lustre; sp. gr. = 6·0 and more. Streak uncolored, or orange-yellow. If orange-yellow; sp. gr. = 6·0 and more, and H. = 3·0 and less.

H. = 2·5 to 5·0. If 5·0; sp. gr. under 4·5.

Sp. gr. = 3·3 to 7·2. If under 4·0 and H. = 5·0; cleavage diprismatic.

Order III.—Kerate (Horny).

Not metallic. Streak uncolored. No single eminent cleavage. H. = 1·0 to 2·0. Sp. gr. = 5·5.

Order IV.—Malachite.

Not metallic. Color blue, green brown. If brown color of streak; H. = 3·0 and less; and sp. gr. above 2·5. If uncolored streak; sp. gr. = 2·2 and less; and H. = 3·0. No single eminent faces of cleavage. H. = 2·0 to 5·0. Sp. gr. = 2·0 to 4·6.

Order V.—Mica.

If metallic; sp. gr. under 2·2. If not metallic; sp. gr. above 2·2. If yellow streak, pyramidal. Single eminent cleavage. H. = 1·0 to 4·5. If above 2·5; rhombohedral. Sp. gr. = 1·8 to 5·6. If under 2·5; metallic. If above 4·4; streak uncolored.

Order VI.—Spar.

Not metallic. Streak uncolored, brown. If rhombohedral; sp. gr. 2·2 and less, or H. = 6·0.

H. = 3·5 to 7. If 4·0 and less; single eminent cleavage. If above 6·0; sp. gr. under 2·5, or above 2·8; and pearly lustre. Sp. gr. = 2·0 to 3·7. If above 3·3; hemiprismatic, or H. = 6·0; and no adamantine lustre. If 2·4 and less; not without traces of form and cleavage.

Order VII.—Gem.

Not metallic. Streak uncolored. H. = 5·5 to 10. If 6·0 and less; sp. gr. = 2·4 and less; and no traces of form and cleavage. Sp. gr. = 1·9 to 4·7. If under 3·8; no pearly lustre.

Order VIII.—Ore.

If metallic; black. If not metallic; adamantine, or imperfect metallic lustre. If yellow or red streak; H. = 3·5 and more; and sp. gr. = 4·8 and more. If brown or black streak; H. = 5·0 and more, or perfectly prismatoidal. H. = 2·5 to 7·0. If 4·5 and less; red, yellow, or black streak. If 6·5 and more; and streak uncolored; sp. gr. = 6·5 and more. Sp. gr. = 3·4 to 7·4.

Order IX.—Metal.

Metallic. Not black. If gray; malleable; and sp. gr. = 7·4 and more. H. = 0·0 to 4·0, or malleable. Sp. gr. = 5·7 to 20·0.

Order X.—Pyrites.

Metallic. H. = 3·5 to 6·5. If 4·5 and less; sp. gr. under 5·0. Sp. gr. = 4·1 to 7·7. If 5·3 and less; color yellow or red.

Order XI.—Glance.

Metallic. Gray, black. H. = 1·0 to 4·0. Sp. gr. = 4·0 to 7·6. If under 5·0, and single perfect cleavage: lead-gray. If above 7·4; lead-gray.

Order XII.—Blende.

If metallic; black. If not metallic; adamantine lustre. If brown streak; uncolored. Sp. gr. between 4·0 and 4·2; and the form tessular. If red streak; sp. gr. = 4·5 and more; and H. = 2·5 and less.

H. = 1·0, 4·0. Sp. gr. = 3·9, 8·2. If 4·3 and more; streak red.

Order XIII.—Sulphur.

Not metallic. Color red, yellow, or brown. Prismatic. H. = 1·0 to 2·5. Sp. gr. = 1·9 to 3·6. If above 2·1; streak yellow, or red.

Class III.

If fluid; bituminous odor. If solid; insipid. Sp. gr. under 1·8.

Order I.—Resin.

Fluid, solid. Streak uncolored, yellow, brown, black. H. = 0·0 to 2·5. Sp. gr. = 0·7 to 1·6. If 1·2 and more; streak uncolored.

Order II.—Coal.

Solid. Streak, brown, black. H. = 0·1 to 2·5. Sp. gr. = 1·2 to 1·5.

The following is his arrangement of simple minerals:—

Class I.

Order I.—Gas.

Genus I. Hydrogen gas.
1. Pure hydrogen gas.
2. Carbureted hydrogen gas.
3. Sulphureted hydrogen gas.
4. Phosphureted hydrogen gas.

Genus II. Atmospheric air.
1. Pure atmospheric air.

Order II.—Water.

Genus I. Atmospheric water.
1. Pure atmospheric water.

Genus II. Sea water.
1. Common sea water.

Order III.—Acid.

Genus I. Carbonic acid.
1. Aëriform carbonic acid.

Genus II. Muriatic acid.
1. Aëriform muriatic acid.

Genus III. Sulphuric acid.
1. Aëriform sulphuric acid.
2. Liquid sulphuric acid.

Genus IV. Boracic acid.
1. Prismatic boracic acid.

Genus V. Arsenic acid.
1. Octahedral arsenic acid.

Order IV.—Salt.

Genus I. Natron.
1. Prismatic natron.

Genus II. Glauber's salt.
1. Prismatic Glauber's salt.

Genus III. Nitre.
1. Prismatic nitre.

Genus IV. Rock salt.
1. Hexahedral rock salt.

Genus V. Sal ammoniac.
1. Octahedral sal ammoniac.

Genus VI. Vitriol.
1. Hemiprismatic vitriol, or green vitriol.
2. Prismatic vitriol, or blue vitriol.
3. Pyramidal vitriol, or white vitriol.

Genus VII. Epsom salt.
1. Prismatic Epsom salt.

Genus VIII. Alum.
1. Octahedral alum.

Genus IX. Borax.
1. Prismatic borax.

Genus X. Glauberite.
1. Prismatic glauberite.

Class II.

Order I.—Haloide.

Genus I. Gypsum.
1. Prismatoidal gypsum, or common gypsum.
2. Prismatic gypsum, or anhydrite.

Genus II. Cryolite.
1. Prismatic cryolite.

Genus III. Alum stone.
1. Rhomboidal alum-stone.

Genus IV. Fluor.
1. Octahedral fluor.

Genus V. Apatite.
1. Rhomboidal apatite.

Genus VI. Limestone.
1. Prismatic limestone, or arragonite.
2. Rhomboidal limestone.
3. Macrotypous limestone.
4. Brachytypous limestone, or rhomb-spar.

Order II.—Baryte.

Genus I. Sparry iron.
1. Rhomboidal sparry iron.
* Spharosiderite.

Genus II. Red manganese.
1. Rhomboidal red manganese
* Manganese spar.

Genus III. Calamine
1. Prismatic, or electric calamine.
2. Rhomboidal calamine.

Genus IV. Tungsten, or scheelium.
1. Pyramidal tungsten.

Genus V. Baryte.
1. Pyramido-prismatic baryte, or strontianite.
2. Di-prismatic baryte, or witherite.
3. Prismatic baryte, or heavy spar.
4. Prismatoidal baryte, or celestine.

Genus VI. Lead-spar.
1. Di-prismatic lead-spar, or white and black lead-spar.
2. Rhomboidal lead-spar, or green and brown lead-spar.
3. Hemiprismatic lead-spar, or red lead-spar.
4. Pyramidal lead-spar, or yellow lead-spar.
5. Prismatic lead-spar, or sulphate of lead.
* 1. Corneous lead-spar.—2. Arseniate of lead.—3. Plomb Gomme.

Order III.—Kerate.

Genus I. Corneous silver.
1. Hexahedral corneous silver.

Genus II. Corneous mercury.
1. Pyramidal corneous mercury.

Order IV.—MALACHITE.

Genus I. Copper green.

1. Uncleavable copper green.

Genus II. Liriconite.

1. Prismatic liriconite, or lenticular arseniate of copper.
2. Hexahedral liriconite, or cubical arseniate of iron.

Genus III. Olivenite.

1. Prismatic olivenite, or prismatic arseniate of copper.
2. Di-prismatic olivenite.

Genus IV. Blue malachite, or blue copper.

1. Prismatic blue malachite.
   * Velvet blue copper.

Genus V. Emerald malachite.

1. Rhomboidal emerald malachite.

Genus VI. Green malachite.

1. Prismatic green malachite, or phosphate of copper.
2. Di-prismatic green malachite, or common malachite.
   * Atacamite.
1. Prismatic atacamite, or muriate of copper.

Order V.—MICA.

Genus I. Copper mica.

1. Rhomboidal copper mica, or micaceous arseniate of copper.
2. Prismatic copper-mica.

Genus II. Uran-mica, or uranite.

1. Pyramidal uran-mica.
   * Uran-ochre.

Genus III. Cobalt-mica, or red cobalt

1. Prismatic red cobalt.

* Cobalt-ochre.
1. Black cobalt-ochre.
2. Brown cobalt-ochre.
3. Yellow cobalt-ochre.

Genus IV. Antimony-mica, or white antimony.

1. Prismatic white antimony.
   * Antimony ochre.

Genus V. Blue iron, or iron mica.

1. Prismatic blue iron, or phosphate of iron.

Genus VI. Graphite.

1. Rhomboidal graphite.

Genus VII. Talc-mica.

1. Prismatic talc-mica, or talc.
   * 1. Native magnesia, or hydrate of magnesia.—2. Ophite.—3. Pikrolite.—4. Nephrite.—5. Steatite, or soap stone.—6. Figurestone, or algalmatolite.—7. Magnesite.—8. Meerschaum.—9. Lithomarge.—10. Mountain soap.—11. Bole.
2. Rhomboidal talc mica, or common mica.
   * Pinite.

Genus VIII. Pearl-mica.

1. Rhomboidal pearl-mica.

Order VI.—SPAR.

Genus I. Schiller-spar.

1. Diatomous schiller-spar, or common schiller-spar.
2. Axotomous schiller-spar, or green diallage.
3. Hemiprismatic schiller-spar, or bronzite.
4. Prismatoidal schiller-spar, or hypersthene.
5. Prismatic schiller-spar, or anthophyllite.

Genus II. Kyanite.

1. Prismatic kyanite.

Genus III. Spodumene.

1. Prismatic spodumene.

Genus IV. Prehnite.

1. Axotomous prehnite.
   * Karpholite.

Genus V. Datolite.

1. Prismatic datolite.

Genus VI. Zeolite.

1. Trapezoidal zeolite, or leucite.
2. Dodecahedral zeolite, or sodalite.
3. Hexahedral zeolite, or analcime.
4. Paratomous zeolite, or cross-stone.
5. Rhomboidal zeolite, or chabasite.
6. Diatomous zeolite, or laumonite.
7. Prismatic zeolite, or mesotype.
8. Prismatoidal zeolite, or stilbite.
9. Hemiprismatic zeolite.
10. Pyramidal zeolite, or albine.
11. Axotomous zeolite, or apophyllite.

Genus VI. Petalite.

1. Prismatic petalite.

Genus VII. Felspar.

1. Rhomboidal felspar, or nepheline.
2. Prismatic felspar, or common felspar.
3. Pyramidal felspar, or scapolite, &c.
   * Elaolite.

Genus VIII. Augite.

1. Paratomous augite, or common augite, &c.
2. Hemiprismatic augite, or hornblende, &c.
3. Prismatic augite, or epidote.
4. Prismatic augite, or tabular spar.

Genus IX. Azure-spar.

1. Prismatic azure-spar, a lazulite.
2. Prismatoidal azure-spar, or blue spar.
   * 1. Azure-stone, or lapis lazuli.—2. Hauyne.—3. Calaite, or mineral turquois.—4. Amblygonite.—5. Diaspore.—6. Gehlenite.

Order VII.—GEM.

Genus I. Andalusite.

1. Prismatic andalusite.
   * Fibrolite. ** Chiastolite.

Genus II. Corundum.

1. Dodecahedral corundum, or spinel.
2. Octahedral corundum, or automolite.
3. Rhomboidal corundum, or sapphire.
4. Prismatic corundum, or chrysoberyl.

Genus III. Diamond.

1. Octahedral diamond.

Genus IV. Topaz.

1. Prismatic topaz.

Genus V. Emerald.

1. Prismatic emerald, or euclase.
2. Rhomboidal emerald.

Genus VI. Quartz.

1. Prismatic quartz, or iolite.
2. Rhomboidal quartz.
3. Uncleavable quartz.
4. Fusible quartz.

Genus VII. Axinite.

1. Prismatic axinite.

Genus VIII. Chrysolite.

1. Prismatic chrysolite.

Genus IX. Boracite.

1. Octahedral boracite

Genus X. Tourmaline.
1. Rhomboidal tourmaline.
Genus XI. Garnet.
1. Pyramidal garnet, or vesuvian.
2. Tetrahedral garnet, or helvine.
3. Dodecahedral garnet.
4. Prismatic garnet, or cinnamon-stone.
5. Prismatoidal garnet, or grenatite.
* Aplome. Eudialite.
Genus XII. Zircon.
1. Pyramidal zircon.
Genus XIII. Gadolinite.
1. Prismatic gadolinite.

Order VIII.—Ore.

Genus I. Titanium ore.
1. Prismatic titanium ore, or sphene.
2. Peritomous titanium ore, or rutule.
3. Pyramidal titanium ore, or octahedrite.
Genus II. Zinc ore.
1. Prismatic zinc ore, or red zinc ore.
Genus III. Red copper ore.
1. Octahedral red copper ore.
Genus IV. Tin ore.
1. Pyramidal tin ore.
Genus V. Wolfram ore.
1. Prismatic wolfram.
Genus VI. Tantalum ore.
1. Prismatic tantalum ore.
* Tantalite.
Genus VII. Uranium ore.
1. Uncleaveable uranium ore.
Genus VIII. Cerium ore.
1. Uncleavable cerium ore.
* Allanite, or prismatic cerium ore.
** Cerin.
Genus IX. Chrome ore.
1. Prismatic chrome ore, or chromate of iron.
Genus X. Iron ore.
1. Octahedral iron ore, or magnetic iron ore.
* Titanitic iron ore. ** Iserine.
*** Menachanite.
2. Rhomboidal iron ore, or red iron ore.
3. Prismatic iron ore, or brown iron ore.
* Bog iron ore. ** Lievrite.
Genus XI. Manganese ore.
1. Prismatic manganese ore, or black manganese.
* Scaly brown manganese ore.
2. Prismatoidal manganese ore, or gray manganese.
* 1. Earthy gray and brown manganese ore, or wad.—2. Phosphate of manganese.

Order IX.—Native Metals.

Genus I. Arsenic.
1. Native arsenic.
Genus II. Tellurium.
1. Native tellurium.
Genus III. Antimony.
1. Dodecahedral antimony.
2. Prismatic antimony, or antimonial silver.
Genus IV. Bismuth.
1. Octahedral bismuth.
Genus V. Mercury.
1. Liquid native mercury.
2. Dodecahedral mercury, or native amalgam.
Genus VI. Silver.
1. Hexahedral silver.
Genus VII. Gold.
1. Hexahedral gold.
Genus VIII. Platina.
1. Native platina.
Genus IX. Iron.
1. Octahedral iron.
1. Subsp. terrestrial native iron.
2. ——— meteoric native iron.
Genus X. Copper.
1. Octahedral copper.
* 1. Osmium.—2. Palladium.—3. Nickel.

Order X.—Pyrites.

Genus I. Nickel pyrites, or copper nickel.
1. Prismatic nickel pyrites.
* Nickel ochre.
** Black nickel.
Genus II. Arsenic pyrites.
1. Axotomous arsenic pyrites.
2. Prismatic arsenic pyrites.
Genus III. Cobalt pyrites.
1. Hexahedral cobalt pyrites, or silver white cobalt.
2. Octahedral cobalt pyrites, or tin white cobalt.
* Gray cobalt pyrites.
** Cobalt kies.
*** Radiated tin white cobalt pyrites.
Genus IV. Iron pyrites.
1. Hexahedral iron pyrites.
2. Prismatic iron pyrites.
3. Rhomboidal iron pyrites, or magnetic pyrites.
Genus V. Copper pyrites.
1. Pyramidal copper pyrites, or yellow copper pyrites.
Undetermined pyrites.
* 1. Nickeliferous gray antimony.—2. Common tin pyrites.

Order XI.—Glance.

Genus I. Copper glance.
1. Tetrahedral copper glance, or gray and black copper.
2. Prismatoidal copper glance.
3. Prismatic copper glance, or vitreous copper.
* 1. Variegated copper.—2. Argentiferous copper glance.—3. Plumbiferous copper glance.—4. Tennantite.—5. Eukairite.
Genus II. Silver glance, or vitreous silver.
1. Hexahedral silver glance.
Genus III. Galena, or lead glance.
1. Hexahedral galena, or lead glance.
* Blue lead.
Genus IV. Tellurium glance, or black tellurium
1. Prismatic tellurium glance.
Genus V. Molybdena, or molybdena glance.
1. Rhomboidal molybdena.
* Molybdena ochre.
Genus VI. Bismuth glance.
1. Prismatic bismuth glance.
* Bismuth ochre.
** Acicular bismuth glance, or needle ore.
Genus VII. Antimony glance.
1. Prismatic antimony glance.
2. Prismatoidal antimony glance, or gray antimony.
3. Axotomous antimony glance, or bournonite.

Genus VIII. Melane glance.
1. Diprismatic Melane glance, black antimony ore of Werner.
2. Prismatic melane glance, brittle silver glance of Werner.

Order XII.—Blende.

Genus I. Manganese blende.
1. Prismatic manganese blende.

Genus II. Zinc blende, or garnet blende.
1. Dodecahedral zinc blende.

Genus III. Antimony blende, or red antimony.
1. Prismatic antimony blende, or red antimony.

Genus IV. Ruby blende.
1. Rhomboidal ruby blende, or red silver.
2. Peritomous ruby blende, or cinnabar.

Order XIII.—Sulphur.

Genus I. Sulphur.
1. Prismatoidal sulphur, or yellow orpiment.
2. Hemi-prismatic sulphur, or red orpiment.
3. Prismatic sulphur, or common sulphur.

CLASS II.

Order I.—Resin.

Genus I. Mellilite, or honey-stone.
1. Pyramidal mellilite, or honey-stone.

Genus II. Mineral resin.
1. Yellow mineral resin, or amber.
2. Fossil copal.
3. Black mineral resin.
4. Retinite.
5. Dysodilite.

Order II.—Coal.

Genus I. Mineral coal.
1. Bituminous mineral coal.
2. Glance coal.

The nomenclature of the species in the above system is founded on the primitive forms of the minerals, on the nature of their cleavage, or the position of their bevelment. Thus in the genus corundum there are three species, the different primitive forms of which are the octahedron, rhomboid, and prism, and hence these are named octahedral, corundum rhomboidal, corundum and prismatic corundum. In the genus Zeolite there are seven species; one of them is named prismatoidal the cleavage being prismatoidal, another axifrangible on account of its axifrangible cleavage.

Professor Jameson of Edinburgh thoughout his valuable works on mineralogy has adhered to the above system with but few alterations. His definitions of the species, &c., are the same, and also his nomenclature; but he has occasionally altered the order of the genera, and arranged them under four classes instead of three. His system, however, so nearly resembles that of Mohs that it would be difficult to notice them separately.

The celebrated Berzelius has attempted to establish 'A pure scientific system of mineralogy by the application of the electro-chemical theory, and the chemical proportions.' The views which he has disclosed are novel and highly important. He defines mineralogy to be the science which treats of the elementary combinations of unorganic substances found in or upon the earth, and of the various forms and the different foreign admixtures under which these bodies make their appearance. By the influence of electricity on the theory of chemistry, this last science has experienced a greater change than by the doctrines either of Lavoisier or Stahl. The object of Berzelius is to show that the influence of the electro-chemical theory extends as much to mineralogy as to chemistry; and also that the doctrine of definite chemical proportions is equally applicable, and will give the same degree of mathematical certainty to the arrangements of a mineralogical system which it has already given to chemistry. From the electro-chemical theory, we have, says he, been taught to seek in every compound body for ingredients of opposite electro-chemical properties; and we have learned from it that the combinations cohere with a force which is in proportion to the degree of opposition in the electro-chemical nature of the ingredients. Hence it follows that, in every compound body, there are one or more electro-positive, with one or more electro-negative ingredients. By electro-positive ingredients, he designates such as have inflammable bodies, or salts for bases; and, by electro-negative, the oxygen and oxides which go to the negative pole of the Voltaic battery. In other words, every substance called a basis, in chemical combination, must have another which acts the part of an acid, though the latter, when uncombined, may not be distinguished by a sour taste, or the property of changing vegetable blues to red. The body which, in one case, is electro-negative, may, in another case, be electro-positive, and may be united to a stronger electro-negative, that is, it may be the basis to a stronger acid.

That silex performs the functions of an acid in the mineral kingdom was an opinion advanced by Mr. Hume so early as 1805, and he adduces its neutralising effects on alkalies in the formation of glass as an example. Berzelius regards this new view respecting the combinations of silex with different bases as the most important step which mineralogy has yet made towards its perfection as a science. It is the most abundant substance of which the surface of the globe is composed, and, according to Berzelius, the illustration of that order of minerals in which it supplies the place of an acid, being the electro-negative ingredient, throws the greatest light over other branches of mineralogy. The minerals of this order are, however, the most numerous, and he has given to them the name of siliciates. As an acid, silex possesses the property of forming siliciates of many different degrees of saturation. The most common are those in which the silex contains the same quantity of oxygen as does the base. These he denominates simply siliciates. When the silex contains twice the oxygen of the base, they are called bisiliciates. When thrice, trisiliciates. But, when the base contains more oxygen than the silex does, they are called subsiliciates, and are designated by the terms bi-subsiliciates, tri-subsiliciates, &c., to announce that the base possesses twice or three times the oxygen of the silex.

The mineralogical arrangement proposed by

Berzelius, is founded on the order of the electro-chemical properties of bodies, beginning with the most electro-negative oxygen, and terminating with the most electro-positive potassium, and placing every compound body according to its most electro-positive ingredients. But he observes that, in the present state of science, we must be content with an arrangement only approximating to precision. He divides simple bodies into three classes. 1. Oxygen; 2. Simple non-metallic inflammable bodies, which he calls Metalloids; 3. Metals. He arranges them in the order in which they follow one another, from the most electro-negative to the most electro-positive, in every class. This order is nearly as follows:—

1. Oxygen.

2. Metalloids.

Sulphur,	Fluoric radicle,
Nitricum, or the radicle of azote,	Boron,
Muriatic radicle,	Carbon,
Phosphorus,	Hydrogen.

3. Metals.

Arsenic,	Lead,
Chromium,	Tin,
Molybdenum,	Nickel,
Tungsten,	Copper,
Antimony,	Uranium,
Tellurium,	Zinc,
Silicium,	Iron,
Tantalum,	Manganese,
Titanium,	Cirium,
Zirconium,	Yttrium,
Osmium,	Glucinum,
Bismuth? (uncertain)	Alumnium,
Iridium,	Magnesium,
Platinum,	Calcium,
Gold,	Strontium,
Rhodium,	Barytium,
Palladium,	Sodium,
Mercury,	Potassium.
Silver,	

Every one of these bodies can constitute a mineralogical family, which will consist of that single body, and all its combinations with bodies that are electro-negative towards it, that is, all those which with some few exceptions precede it in the above series. Thus there may be as many families as there are simple substances. The families he divides into orders, according to the different electro-negative bodies with which the most electro-negative are combined. It must be confessed that the obstacles which oppose themselves to the formation of a complete mineralogical system, on the principles proposed by Berzelius, appear to be great, particularly with respect to many of the minerals that never occur crystallised, as it seems that we have no means of determining the proper constituent ingredients from the mechanical admixtures which they may contain. If, indeed, chemistry should ever attain that high degree of perfection which will enable us to discover the limits of all the possible combinations of the elementary parts of minerals, we may then subtract from our analyses those parts which do not fall within these limits, as being in mechanical admixtures, in the same manner as the chemist is now enabled to determine, from the doctrines of definite proportion alone, the quantity of uncombined acid or alkali that exists in a saline solution, when either of the ingredients is in excess.

If one class of stony bodies consists of salts, in which silex performs the functions of an acid, combining with them in definite proportions, the discovery of these proportions in the different combinations is certainly most important.

The late Dr. Clarke of Cambridge also published an arrangement of minerals purely chemical, in which the earths are considered as the oxides of metals, which cannot exist in any other state in our atmosphere. Thus barytes is an oxide of barium and silicium, zircon of zirconium and silicium, garnet an oxide of silicium, calcium, aluminum, and iron, and so on with the other genera. This system, however, has not been generally received, and indeed a more intimate acquaintance with the chemical properties of minerals than we at present possess will be necessary before any complete chemical arrangement can be formed.

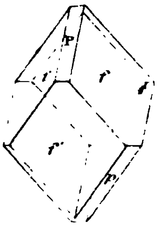
Mr. Brooke, in his well known work on Crystallisation, has recommended an alphabetical arrangement of mineral substances as greatly facilitating the reference to particular specimens; and it will appear to deviate less from natural classification when we recollect that, strictly speaking, there is no natural connexion or order to supersede this method. No natural properties can determine whether zircon should be placed before or after silex, or whether lead should precede or follow iron or copper. There may be conceived to be as many natural classifications of minerals as there are physical properties common to the substances to be arranged. Thus the metals might be arranged according to their fusibility, or their ductility, or their specific gravity. Either of these characters might be adopted as the basis of a natural classification, and the order of the substances thus classed would vary according to the generic character adopted.

Acting upon these principles Mr. Brooke has given an arrangement of the mineral genera in alphabetical order, collected however into certain chemical groups, and containing accurate descriptions of the primitive forms.

In the year 1817 Dr. Brewster announced to the Royal Society the existence of what he calls a physical law, by which the primitive forms of crystallised bodies can be referred from the number of their axes of double infraction. He also asserts that every variation in the position, the intensity, and the character of these axes in smaller minerals is found to be accompanied by a difference of chemical composition; while a difference of chemical composition also denotes a difference of optical structure. All the combinations also of the sulphuric and tartaric acids with a single, earthy, alkaline, and metallic base, are found to have two axes of double refraction. In a memoir printed in the Wernerian Transactions Dr. Brewster pursued this subject to a greater length and stated that the law having been established, by a comparison of his own ex-

MINERALOGY.

Fig. 1.



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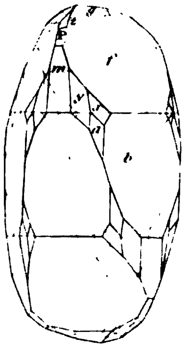
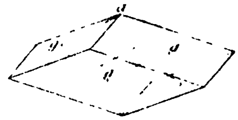


Fig. 3.

Fig. 4.



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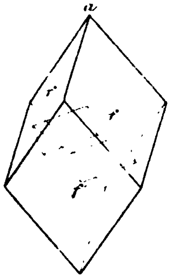

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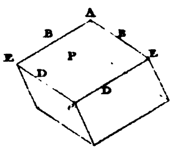

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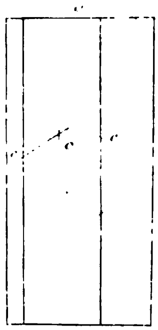

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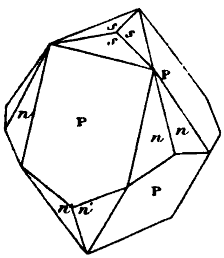

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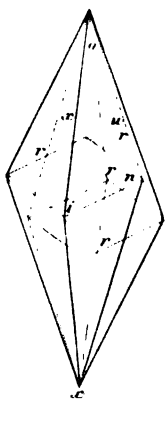
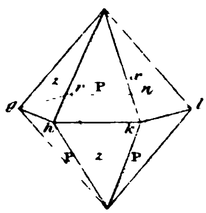


Fig. 9.



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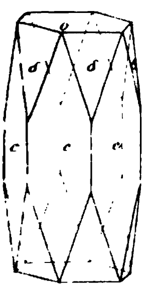

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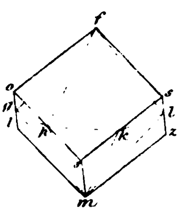

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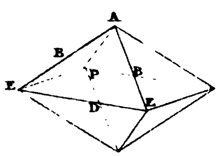

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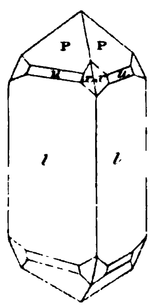

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J. Shury sculp.

periments on polarised light with the tables of primitive forms given by the abbé Haüy, there appeared to be eleven exceptions, which were as follows:—

Sulphate of magnesia,	Cryolite,
Chromate of lead,	Harmotome,
Mesotype,	Chabasie,
Carbonate of barytes,	10 Sulphate of iron,
5 ———— strontites,	Essonite.
Iolite,	

'These exceptions, says Dr. Brewster, to a law otherwise general and comprehensive, were ascribed by myself and others to the circumstance of the primitive forms of the minerals having been erroneously determined; and as I was then aware, from actual experiment, that the optical structure of a crystal was dependent on the mechanical condition of its parts, I did not scruple to predict, and to publish the prediction, that all these eleven exceptions had their foundation in crystallographic errors, and that these minerals would be found to possess primitive forms, in perfect conformity with the general optical law which I had discovered. Crystallography and optics were thus fairly placed at issue, and there was no method of evading the decision of the mineralogists of Europe. If these eleven bodies were found to possess the primitive forms assigned to them by Haüy, the optical law which I promulgated must have instantly fallen to the ground as an imposing though imperfect generalisation, and the crystallographic method must have enjoyed the proudest triumph. The result, however, of this trial of strength was very different indeed. All the minerals out of the eleven which have been carefully re-examined by mineralogists, have been found to have different primitive forms from those assigned to them by Haüy, and in all of them has my prediction been accomplished.'

'That optical law,' continues the doctor, 'which connects the primitive forms of minerals with the number of their axes of double refraction stands pre-eminent among crystallographic generalisations, without a single ascertained exception; it has corrected the deductions of the most distinguished crystallographers of Europe; it has enabled those who confide in its accuracy to predict the results of crystallographic researches; and, what has not been sufficiently attended to, it is a law founded on experimental evidence, that the optical phenomena are the necessary results of a mechanical structure, and that their indications must infallibly harmonise with the sound deductions of crystallography. It not only decides the class of primitive forms, but it determines, which crystallography is incapable of doing, those limiting solids which form the nodes of every series of geometrical bodies. If we take a crystal, for example, bounded by six equal square faces, the crystallographer will content himself with calling it a cube; but the optical mineralogist will only call it a cube when it has no double refraction. He will maintain it to be a rhomb, if it has a single axis of double refraction, coincident with one of its diagonals; and he will consider it as a right prism with a square base, if it has a single axis of double refraction, perpendicular to any two of its faces. The position of the axis of double refraction shows, that the mechanical condition of the parts of the crystal is related to that line in which it is invariably found in every rhomboid, and in every prism with a square base.' Dr. Brewster concludes by contending that, if the physiology of mineral bodies shall ever attain to the dignity of a science, its foundations must be laid upon optical results, and its progress directed by the unerring light of optical analysis!

Of the *comparative merits* of the various systems we have described our different readers will form their ideas according to the degree in which they may have previously investigated them: while those who have never examined the subject will perhaps feel intimidated from undertaking any estimate. Into a particular or lengthened analysis of their differences our limits will not allow us to enter: a comparative sketch of their most striking features is all we can afford.

But the same reasons which require a distribution of natural science into different branches render subdivisions and arrangement in each branch peculiarly useful and important, and make necessary an acquaintance not only with the mere facts involved, but with the mutual relations that exist between them. On the basis of the whole must be established a just systematic arrangement. Such arrangements have already been successfully effected in zoology and botany; but in mineralogy difficulties arise which do not exist in classing the animal and vegetable tribes:—they make their appearance, indeed, at the very foundation of the system, viz. in forming the species. Could we satisfactorily determine what constitutes a mineral species, little difficulty would remain in forming the other divisions; but, deprived of organisation, a mineral has not the power of producing another like itself, a circumstance which, in the animal and vegetable kingdoms, is the great preservative of all the species. In bodies possessing organic structure, therefore, one species never passes into another by imperceptible degrees; whereas minerals, being formed merely by the juxtaposition of their parts, and being continually subject to the influence of external agents during the period of their formation, are frequently contaminated by foreign substances, by which different species become confounded in their appearance and properties.

It must hence be obvious that no small difficulty attends the determination of the species in mineralogy; and accordingly we find that different opinions have been entertained, and different methods employed. These however may be all comprised under the four following heads:— I. *The chemical system*, or that which is founded on a knowledge of the different elements of which minerals are composed, and the different proportions in which they are combined. II. *The mixed method*, advocated by Werner, Hoffman, and Kirwan, in which the species are determined and arranged according to the chemical and external character conjoined. III. *The external or crystallographic method*, depending

principally on the primitive crystalline forms of minerals as determined by their cleavage &c. And, IV. *The optical system*, which professes to arrange minerals according to their various powers of polarising and modifying light. Of these we certainly feel inclined to prefer a *mixed method*, similar to that of professor Cleaveland of New York, and in which the chemical character should certainly predominate. The arrangements of science, like the letters of the alphabet, may be used by children as mere objects of amusement, but are employed by men with some ultimate view, to express ideas, or to explain phenomena. In botany and zoology the objects, as they exist, are made conducive to the comfort of man; but the greater part of the mineral substances must be decomposed before they can be used by him. An arrangement having some connexion therefore with their properties *when so decomposed* must obviously be the most useful: we must in some cases rely chiefly on the external, and in others chiefly on the internal, characters; but, in all cases in which ambiguity remains, the final decision, in our view, should rest with the latter.

The chemical system, however, is not without its objections, and of these the most important appears to be the imperfection of its analysis. When the chemist determines that two bodies have the same ingredients, he is ignorant of the manner in which these ingredients are combined. If the analysis of a quadruped and a bird indicated the same elements, he could not discover that these formed horn and hair in the one, while, in the other, they displayed themselves in the finest plumage. The chemist must always fail in detecting structures, because he commences his operations by destroying them. He examines a mineral in its ruins; and after its parts have been separated, by the disintegrating power either of heat or acids, he may determine the quantity; but he is frequently ignorant of the nature of those volatile parts which escape during the destroying process. The fluoric acid, for example, in certain micas, eluded the penetration of Vauquelin, and the same gas was not discovered by Berzelius in his first analysis of apophyllite. With all the skill of modern chemistry, we are yet unable to determine which of the component parts of minerals are essential to the composition of the substance analysed, and which are but accidental mixtures. In the instance of the crystallised sandstone from Fontainbleau, no doubt can be entertained that either the carbonate of lime, or the grains of sand, must be regarded as accidental mixture, and foreign to the constitution of the species, according as we choose to consider the specimens, as arenaceous quartz agglutinated by carbonate of lime, or as carbonate of lime enclosing grains of quartz. It would, however, present little difficulty to the chemist to determine that the silex and lime are not chemically combined in the sandstone: but there are numerous other instances in which even the sagacity of a Berzelius has probably failed in discriminating the matter accidentally present in several of the species of minerals which have been analysed, from that which is essential to the composition of each particular species. In some instances the destruction of the mineral in order to analyse it cannot be allowed. Diamonds, rubies, emeralds, and other precious stones, were well distinguished by their external characters long before their internal properties were known, if even now they can be said to be so. It were indeed a melancholy circumstance for a jeweller if he had no other certain way of distinguishing his gems but by one which necessarily implies their previous destruction.

'In regard to the human intellect,' observes professor Mohs, 'the value of the information derived from natural history and from chemistry is absolutely equal. It is an erroneous idea that chemistry penetrates into the interior of bodies, and, therefore, a reprehensible practice to reproach natural history with being confined to their external appearances. It will always remain impossible to perceive the internal disposition. The analysis of a body does not disclose its interior, or its component particles, but only the exterior of the results obtained by the operations, the substances themselves, and their relations to each other. The body which has been analysed disappears, as it were, from nature; and in its stead other bodies are produced, which, as such, did not exist before. In the same manner, two or more bodies, if joined by chemical action, will disappear, and give rise to a new one, in which they no longer exist as they were before.'

It is indeed sufficiently evident that neither chemistry nor natural history can disclose the essence or interior of bodies; but surely that investigation which exhibits most of the properties for which they are valuable to man is most worthy of his attention. But chemistry alone will not suffice for the basis of a mineral arrangement; for unless we could again recognise, by its external character, a species already analysed, each individual must be destroyed to discover its place in the system. To unite the two systems seems, therefore, the most advisable plan.

Concerning the prevailing system of M. Mohs we fear, however, that we entertain very heretical opinions. We object to the undue prominence given in this system to crystallography; which, as very many important classes of minerals, as coal, chalk, slate, &c., are destitute of crystalline structure, can never be of universal application. The destruction, even of a crystallised unknown species, is equally necessary to discover its primitive form, as to complete its chemical analysis; and, when we take into consideration the frequent occurrence of isomorphous crystals, little more accuracy can be claimed for one mode than for the other. 'It demands,' observes Mr. Brooke, 'great precision of hand and eye to obtain the true measurements of angles to a minute only, and we cannot say that a difference of species may not exist, with a difference of only a few seconds in the angles of inclination of their planes. We know that the greater angle of a right rhombic prism must lie somewhere between 90° and 180°. If the angle were 90°, the prism would be square, and 180° would reduce the prism to a plane. But, between 90° and 180°, we do not know how many dif-

ferent prisms may exist. If they differed by degrees only, their number could exceed eighty-nine. If the difference consisted of minutes, there might be 5399 such prisms, all distinguishable by the goniometer; but, if the differences consisted of seconds only, there might evidently be 323,999 rhombic prisms, of which no more than 5399 could be distinguished by the ordinary goniometric instruments.' We object again to that vagueness of definition which can allow the introduction of atmospheralia into a mineral arrangement, and the collection of earthy and metalliferous minerals into one class merely because their specific gravity is above 1·8. From M. Mohs's definition it is really impossible to understand what simple minerals are. Porcelain, earth, and green earth, are rejected because chemistry, whose assistance the professor seems to despise, has discovered them to be decompositions of felspar and talc-mica. Iron-flint, heliotrope, jasper, tile-ore, clay, tripoli, yellow earth, and many others, are considered to be mixtures as much as granite, though the component particles are undistinguishable, by reason of their smallness. Hence no one of them is treated even as a particular species in his arrangement of the mineral kingdom. Basalt, claystone, serpentine, &c., are likewise held to be mixtures.

In the mean time water and atmospheric air are ranked as simple minerals, although certainly chemical compounds; and the interference of the chemist is deprecated, though the system is founded upon the results of his labors. If hydrogen be included among minerals, merely because it is produced by the earth in certain places, then with equal propriety may oxygen be arranged among the plants, because produced by them naturally and constantly. 'Surely this system,' to adopt a favorite phrase of professor Mohs's, 'carries with it its own refutation.' Yet it should be observed, that the professor considers the application of his ideas 'too confined, if we consider as natural productions only those bodies for which nature itself has produced the essential circumstances and causes of formation. A number of salts, and other bodies, obtained by the aid of chemistry, would in that case be excluded, and considered as artificial productions, although the part which art, or the control of man, takes in their formation, is entirely limited to the mere production of those circumstances under which nature may exert, in producing those new combinations, the same powers which enter into action when the other bodies are produced.' We need only observe that the same arguments would reduce the whole of chemical philosophy, and even caloric and light, within the scope of professor Mohs's mineral kingdom. We cannot better conclude these remarks on the external system than by the following queries of professor Cleveland:—

'Can similarity of color,' says he, 'or of form, fracture, hardness, &c., constitute a resemblance so perfect, as that which arises from identity of composition? Or can a difference of color, form, fracture, &c., establish so important a distinction between minerals, as that which is produced by dissimilarity of composition? Would not two minerals, both composed of phosphoric acid and oxide of lead, in the same proportion, belong to the same species, although the color of one should be brown, and that of the other green? Would not two minerals, composed of phosphoric acid and lime, in the same proportion, belong to the same species, although the forms of their crystals, essentially the same, should exhibit different modifications? In fine, can properties liable to numerous variations, from trivial and accidental causes, be supposed to establish the identity of two or more minerals with that degree of evidence which is afforded by a well ascertained similarity in composition? We hesitate not to answer these questions by saying, that the true composition of minerals ought to be the basis of arrangement; and by this ought the species to be established. The composition of a mineral, that is, the ingredients proper and essential to its composition, may remain unaffected by the accidental presence of certain foreign ingredients, which materially change several of the external characters.'

The optical system of Dr. Brewster has been before the public so short a time that no final opinion can be given as to its merits. He appears to have examined a very considerable number of mineral and other bodies by means of polarised light, and has been led by this examination to the following optical classification of crystals:—1st. Those in which only one axis of double refraction has been yet observed; which include nearly all the crystals comprised in the first and second of Mohs's systems. 2dly, Those which possess two axes, consisting of nearly, if not entirely, the whole of Mohs's third system. But some, which crystallographically belong to the first and second systems, are also included by Dr. Brewster in this. 3dly, Those in which no double refraction has been yet discovered, either by direct experiment, or by means of polarised light, and which belong to the fourth system of Mohs.

Out of these facts, which, we must allow, are very numerous, and hence very imposing, Dr. Brewster has produced two optical systems; one relating to mineralogy generally; and the other relating to compounds of sulphuric and tartaric acids, with earthy, alkaline, and metallic bases, all of which are said to have two or more axes of double refraction. But in the Philosophical Transactions for 1816, Dr. Brewster announces the discovery, that *muriate of soda, fluor-spar* and *diamond*, which belong to the *tessular system* of Mohs, and hence ought to possess *no double refraction*, may receive that property by *compression or dilatation*. And, in the volumes for 1816 and 1818, it is stated, *that all the properties of regular crystals might be communicated permanently to glass, and other crystallised bodies, by heat.* This completely, in our humble estimate, overturns the basis of the system. If optical phenomena are to constitute specific characters among minerals, does it not follow either that glass changes its species with its change of optical character, or that optical characters are insufficient to distinguish species? We fear we must conclude with Mr. Brooke, 'that the connexion between the optical characters of minerals and

their crystalline forms is not yet sufficiently understood to make it available for mineralogical purposes.

PART III.

THE ARRANGEMENT OF KNOWN MINERAL SUBSTANCES.

The description of minerals, and their arrangement in systematic order, seem most naturally to result from an investigation of certain relations which minerals bear to our senses, or to other objects. Some of these are discoverable by mere inspection, or, at most, require some simple experiment to be made upon the mineral to ascertain its hardness, structure, &c., but without producing any important change in its natural state; while others cannot be observed without a partial or complete decomposition of the mineral. All these properties, when employed for the purpose of discriminating minerals, are usually called characters, and are as follows:—

General Characters.

The general characters are, color, cohesion, unctuosity, coldness, weight, smell, taste.

Color.—The colors of minerals are distinguished into fundamental and compound. Fundamental colors are eight in number; namely, snow-white, as Carrara marble; ash-gray, as wacken; velvet-black, as jet; Berlin or Prussian blue, as sapphire; emerald-green, as fluor spar; lemon-yellow, as in yellow orpiment; carmine-red, as in cinnabar. Chestnut brown, the color of the ripe chestnut.

Compound colors are, 1. Of the whites, reddish-white, or snow-white mixed with a crimson-red, as porcelain; yellowish-white, or snow-white with a lemon-yellow, as white amber; silver-white or grayish-white, as silver; greenish-white, or snow-white mixed with a little emerald-green, and ash-gray, as gypsum, quartz, &c.; milk-white, or snow-white, with a little Berlin and ash-gray, as chalcedony. 2. Of the grays, the lead-gray, or ash-gray, with a little blue metallic lustre, as galena; bluish-gray, or ash-gray, with a little blue, as bluish gray clay; smoke-gray, or ash-gray, with a little brown, as gray-hornstone; pearl-gray, i.e. gray with a little crimson-red and blue, as quartz; greenish-gray, i.e. with a little emerald-green, and sometimes a trace of yellow, as in cat's-eye, prehnite, &c.; yellowish-gray, i.e. with lemon-yellow and a trace of brown, as yellowish-gray chalcedony; steel-gray, i.e. gray with a little blue and a metallic lustre, as gray copper ore. 3. Of blacks, the grayish-black, or velvet-black, with a little ash-gray, as in basalt; iron-black, darker than the preceding, with a metallic lustre, as in magnetic iron-stone; pitch-black, with a little brown and yellow, as pitch-stone; raven-black, with a little brown, yellow, and green, as in black blende; bluish-black, as in black cobalt. 4. Of blues, the indigo blue, or Berlin blue, with a little black, as in blue martial earth; azure-blue, with a little red, as in lapis lazuli; violet-blue, with much red, and a little brown, as in fluor spar and amethyst, &c.; lavender blue, with a little gray, as in jasper; smalt-blue, with white, a little gray, and a trace of red, as in azure copper ore; sky-blue, as in blue fluor spar. 5. Of greens, the verdigris-green, of emerald-green, with much Berlin blue, and a little white, as in green copper ore: mountain-green, with a little yellowish gray, as in actynolite; apple-green, with a little grayish-white, as in chrysolite; grass-green, with a little lemon-yellow, as in chrysoprase; blackish-green, with a considerable portion of black, as in green serpentine; pistachio-green, with a little yellow and brown, as in chrysolite; asparagus green, with a little grayish-white, as in chryso-beryl; olive-green, with much brown, as in garnet; siskin-green, with much lemon-yellow, and a little white, as in green lead ore. 6. Of yellows, the sulphur-yellow, or lemon-yellow, with much emerald green and white, as in native sulphur; gold-yellow, straw-yellow, with much grayish-white, as in calamine and bismuth ochre; honey-yellow, with chestnut-brown; wax-yellow, i.e. reddish-brown, with a little ash-gray, as in common opal; ochre-yellow, with much chestnut-brown, as in iron ochre, calamine, &c.; orange-yellow, with a little carmine-red, as in red orpiment; brass-yellow, with the metallic lustre, as copper pyrites; cream color, or Isabella-yellow, with grayish-white, and a little brown and red, as in sparry iron ore; wine-yellow, with reddish, brown, and gray, as yellow calcareous spar. 7. Of reds, the aurora-red, or carmine-red, mixed with much lemon-yellow, as in red orpiment; hyacinth-red with lemon-yellow, and a little brown, as in the hyacinth, and in brown blende; brick-red, with much grayish-white, as in porcelain jasper; scarlet-red, with a very little lemon-yellow, as in red cinnabar; copper-red, as in native copper; blood-red, scarlet-red mixed with brownish-black, as in Bohemian garnet; cochineal-red, carmine-red mixed with bluish-gray, as in cinnabar; crimson-red with much blue, as in ruby; columbine-red, with more blue, and a little black, as in red cobalt ore; flesh-red with grayish white, as in felspar; rose-red, cochineal-red mixed with white, as in red zeolite; peach-blossom-red, crimson-red mixed with white, as in striated and earthy red cobalt ores; cherry-red, crimson-red mixed with much brownish-black, as in red argillaceous iron-stone; brownish-red, blood-red mixed with brown, as in red earthy iron-stone 8. Of browns, the chestnut-brown, mixed with a little red and yellow, as in brown tin ore; clove-brown, with cochineal-red and a little black, as in rock crystal; hair-brown, clove-brown mixed with ash-gray, as in wood-tin ore from Cornwall; yellowish-brown, chestnut-brown with a considerable portion of lemon-yellow, as in brown iron ochre and jasper; pinchbeck-brown with the metallic lustre, as brown mica; wood-brown, yellowish-brown with much ash-gray, as in bituminous wood; liver-brown, as in brown cobalt ore; blackish-brown, chestnut-brown and black, as in mineral pitch.

In respect to *intensity*, colors are either dark, deep, or light; or they are said to incline to one another, or to pass into one another; and, when they lose their original color, to be tarnished. When different colors appear in the same mineral,

they may be disposed in clouds, dots, streaks, rings, veins, zones. &c.

Cohesion.—In respect to cohesion minerals are either solid, friable, or fluid.

Unctuosity.—In respect to unctuosity they are either greasy or meagre.

Coldness, &c.—In respect to coldness they vary only in degree; and in respect to smell and taste the distinctions are too obvious to need description.

Weight.—The weight of minerals is accurately discovered by taking the specific gravity by means of a hydrostatic balance.

Specific gravity.—The specific gravity of a body is its weight, compared with that of another body of like magnitude. The usual standard employed is distilled water, 1 cubic foot of which weighs 1000 ounces avoirdupois. This may be called 1000, or 100, or 10, or 1, adding decimals. If we assume 1 as the standard, then, as the weight which a body loses in water is to its absolute weight, so is 1 to the specific gravity required. If the mineral be lighter than water, add the weight which is necessary to sink it in water to its weight in air; and say, as the sum is to its weight in air, so is air to its specific gravity.

On this principle is founded the method of taking specific gravities by the instrument commonly called Nicholson's Portable Balance. The body of this instrument is a hollow cylinder of tinned iron, of which each extremity terminates in a cone. From the vertex of the upper cone a small stem of brass rises perpendicularly, bearing on its upper extremity a small tin cup. From the vertex of the lower cone is suspended a similar cup, attached to a cone of lead underneath it as a ballast. Both the cups may be removed, when the balance is not in use. When this instrument is placed in a vessel of water, a portion of the cylinder ought to swim above the surface. The tin cup is then to be loaded with weights, till the instrument sinks so far that the surface of the water may exactly coincide with a mark on the brass stem. The quantity necessary to make the instrument sink thus far may be marked on the cup, as a given quantity for future use.

Suppose this quantity to be 600 grains, which may be called the balance weight, and will serve for taking the specific gravity of any substance, whose absolute weight is not greater than that of the balance weight. To ascertain the specific gravity of a mineral, place it alone in the upper cup, and add weights, till the mark on the stem coincides with the surface of the water; and suppose this to be 210 grains. Subtract the 210 grains from the balance weight of 600 grains; and the remaining 390 grains is the absolute weight of the mineral in air. Let the mineral be now removed to the lower cup; but, as it weighs less in water than in air, the mark on the stem will rise a little above the surface of the water. Additional weights must now be placed in the upper cup, till the mark on the stem again coincides with the surface of the water. Suppose this to be eighty grains, which will of course be the weight of a quantity of water precisely equal in bulk to the mineral. We now have the absolute weights of equal bulks of water and of the mineral; then say, as 80 : 390 : : 1000 : 4875, the specific gravity.

If the mineral under examination be lighter than water, it must be confined, when weighed in the lower cup; and the weight of whatever confines it is to be regarded as belonging to that of the instrument. In other respects the process is the same as the preceding.

If the mineral very sensibly absorb water, the weight of the water imbibed must be ascertained by again weighing the mineral in air; and is then to be added to the first term of the proportion.

Particular Characters.

The particular characters comprehend the general aspect, aspect of the surface, aspect of the cleavage, aspect of the distinct concretions, hardness, and adhesion to the tongue.

General aspect.—Under the general aspect are comprehended the transparency, streak, and soiling.

In respect to transparency, minerals are said to be transparent when objects can be seen distinctly through them; semitransparent when seen indistinctly through them; translucent when light passes through them, but not in such quantity that objects may be discerned through them; opaque when no light is transmitted; hydrophanous when opaque minerals become transparent in water. When objects are seen double through a transparent mineral they are said to refract doubly. The streak, or scratch, is the mark left by the scratching a mineral, which is termed similar if it be of the same color as the mineral, or dissimilar if of a different color. Soiling is the stain which some minerals leave when rubbed on the fingers, or on paper.

Aspect of the surface.—To the aspect of the fracture belong the shape of the mineral, the kind of surface, and the lustre of the surface. The external shape is common when it is too irregular to be compared, in respect to form, with any other body, as when it composes the part of a solid rock, and is called massive; or when it is very small, and is said to be disseminated. When it occurs loose it is either in angular pieces, in grains, in plates, or in membranes. The external shape is denominated particular when it may be compared with that of any other body. Of this description are the dentiform, filiform, capillary, globular, reniform, cellular, amorphous, vesicular, &c., whereby is indicated the body which the mineral resembles in shape. The shape of minerals is moreover denominated regular when they occur in a crystallised state (vide Crystallisation and Chemistry); and extraneous when they are of the nature of petrifactions. The external surface of minerals is uneven when it has small unequal elevations and depressions; granulated when composed of small round elevations, like shagreen: rough when the elevations felt are too small to be distinctly seen; smooth, as in the hæmatites; streaked, as in rock crystals, &c.; and drusy when coated with small crystals, as the quartz. External lustre is of two

kinds, common and metallic; the latter of which is subdivided into semimetallic, adamantine, pearly, resinous, and glassy. In point of intensity, the lustre is splendent when it may be seen at a great distance in the daylight; shining when the light is reflected weakly at a distance; glistening when the lustre is visible at no greater distance than an arm's length; glimmering when the surface held near in full daylight presents a number of shining points; dull when the surface has no lustre.

Aspect of the cleavage.—Cleavage is the property which minerals possess of splitting in certain determinate directions. The faces or planes thus obtained, which are termed the faces of the cleavage, are more or less smooth and shining. The forms contained under these faces are called forms of cleavage, or cleavage forms.

The cleavage-forms represent members of the series of crystallisation of those mineral species to which the mineral having the cleavage belongs. The same may be inferred of such individuals or species as possess more than any cleavage form. Hence cleavage extends the application of crystallography in the mineral kingdom, because a mineral, although it be not crystallised, may be cleavable, and thus allow the series, at least the system of crystallisation, to be made out by cleavage in most of the cases, where no regular crystallisations occur.

The cleavage forms are designated like those of crystallisation. Cleavage-forms, Mohs remarks, if among the number of those which in the preceding pages served as a basis to the derivation, are by preference chosen for representing the fundamental form in the species to which they belong; as in rhomboidal calc-spar, the rhomboid of 105° 5′. This rule, however, suffers an exception in the case of a rhomboid or a pyramid, which occur as cleavage-forms, being too obtuse or too acute. For this reason, in pyramidal copper pyrites, the fundamental form is P, though the cleavage form is P+1. No cleavage form whose dimensions are infinite can be employed as a fundamental form.

Hardness.—The degrees of hardness or their limits are by Kirwan, Mohs, and others expressed by numbers. The most precise scale of hardness is that of Mohs, in which the degrees are determined according to the following scale:—

1. Denotes the degree of hardness of common talc and Venetian talc.
2. Is the hardness of a variety of prismatoidal gypsum, with an imperfect cleavage and imperfect transparency. Varieties perfectly transparent and crystallised are commonly too soft.
3. Hardness of a cleavable variety of calcareous spar.
4. Hardness of fluor spar.
5. Hardness of apatite.
6. Hardness of prismatic felspar.
7. Hardness of rhomboidal quartz.
8. Hardness of prismatic topaz.
9. Hardness of rhomboidal corundum.
10. Hardness of octahedral diamond.

Adhesion to the tongue.—This property in minerals varies in the degrees of strong, rather strong, weak, and very weak. Some admit of no adhesion.

The above-mentioned properties are all comprehended under the general name of external characters, in distinction from the physical and chemical characters by which some minerals are known.

Physical Characters.

The most common and obvious of the physical characters is the electrical property which some minerals possess. Some minerals become electric when heated, others when rubbed. The electricity thus excited is in some positive or vitreous; in others it is negative or resinous. The magnetic property of some minerals, particularly of the iron ores, is well known, as also the phosphorescent property of others, particularly the varieties of the blende. To the Lemnian earth, and other boles, belong the peculiar property of making a crackling noise when split and thrown into water; and other minerals have particular properties by which they might be sufficiently distinguished.

Chemical Characters.

By chemical experiments the nature of many mineral substances may be easily and quickly ascertained. The fusibility of many minerals is determined by the blow-pipe. The effervescing property of some bodies is determined by means of acids, particularly nitrous acid. Ammonia, or the volatile alkali, dissolves copper, and assumes a blue color; acetic acid is employed as a test of lead, by its communicating to the acid a sweetish taste. In this manner discriminating characters are derived from the chemical properties of minerals, which may answer the purpose of classification in many cases full as well as the external characters.

Of the analysis of earths and stones.—When any of these substances are to be tried, we must not begin immediately with the blow-pipe; till some preliminary experiments be made, by which those in the fire may afterwards be directed. For instance, a stone is not always homogeneous, or of the same kind throughout, although it may appear to be so. A magnifying glass is therefore necessary to discover the heterogeneous particles, if there be any; and these ought to be separated, and every part tried by itself. This might happen with some of the finer micæ, which are now and then found mixed with small particles of quartz, scarcely to be perceived by the eye. The trapp (German schwartzstein) is also sometimes mixed with very fine particles of feldt spar (spatum scintillans), or of calcareous spar, &c.

After this experiment the hardness of the stone must be tried with steel. The flint and garnets are known to strike fire with steel; but there are also other stones, which are so hard as likewise to strike fire. There is a kind of trapp of that hardness, in which no particles of feldt spar are to be seen. Colored glasses resemble true gems; but, as they are very soft in proportion to these, they are easily discovered by the file. The common quartz crystals are harder than colored

glasses, but softer than gems. The loadstone discovers the presence of iron, when it is not mixed in too small a quantity in the stone, and often before the stone is roasted. Some kinds of hæmatites, and particularly the cœrulescens, greatly resemble some other iron ores; but this is distinguished from them by a red color when pounded, the others giving a blackish powder.

The management of the BLOW-PIPE is described under that article; but a few particulars must be here added.

The blue flame is the hottest; this ought, therefore, to be forced out when a great heat is required; and only the point of the flame must be directed upon the subject which is to be assayed. Its upper end must be bended towards the matter intended to be heated, and the stream of air must be directed along the surface of the bended part, so as not absolutely to touch it.

The piece of charcoal made use of in these experiments must not be apt to crack. If this should happen it must gradually be heated until it does not crack any more, before any assay is made upon it. If this be not attended to, but the assay made immediately with a strong flame, small pieces of it will split off in the face and eyes of the assayer, and often throw along with them the matter that was to be assayed. Charcoal which is too much burnt consumes too quick during the experiment, leaving small holes in it, wherein the matter to be tried may be lost; and charcoal that is burnt too little catches flame from the candle, burning by itself like a piece of wood, which likewise hinders the process.

Of the substance to be assayed, only a small piece must be broken off, not bigger than that the flame of the candle may be able to act upon it at once, if required; which is sometimes necessary, as when the matter requires to be made red-hot throughout, the piece ought to be broken as thin as possible; the fire having then more influence upon the subject, and the experiment being more quickly made.

Some mineral bodies are very difficult to be kept steady upon the charcoal during the experiment, before they are made red-hot; because, as soon as the flame begins to act upon them, they split asunder with violence, and are dispersed. Such are, for instance, the calcareous spar, the sparry gypsum, sparry fluor, white sparry lead ore, the potter's ore, the tessellated mock lead or blende, &c., and all the common fluors which have no determinate figure. These not being so compact as common hard stones, when the flame is immediately urged upon them, the heat forces into their clefts or pores, and causes this violent expansion and dispersion. Many clays are likewise apt to crack in the fire, which is mostly owing to the humidity, of which they always retain a portion.

The only way to prevent this inconvenience is to heat the body as slowly as possible. First heat that place of the charcoal where the piece is intended to be put, and afterwards lay it thereon: a little crackling will then ensue, but commonly of no great consequence. The flame is then to be blown very slowly towards it, in the beginning not directly upon, but somewhat above it, and so approaching nearer and nearer with the flame until it become red-hot. This will do for the most part; but there are nevertheless some, which, notwithstanding all these precautions, it is almost impossible to keep on the charcoal. Thus the fluors are generally the most difficult; and as one of their principal characters is discovered by their effects in the fire per se, they ought necessarily to be tried that way. For this purpose it is best to make a little hole in the charcoal to put the fluor in, and then to put another piece of charcoal as a covering upon this, leaving only a small opening for the flame to enter. As this stone will nevertheless split and fly about, a large piece thereof must be taken, in order to have something of it left. But, if the experiment is to be made upon a stone with fluxes, then a piece of it ought to be forced down into melted borax, when always some part of it will remain in the borax, notwithstanding the greatest part may sometimes fly away by cracking.

As the stones undergo great alterations when exposed to the fire by themselves, whereby some of their characteristics, and often the principal, are discovered, they ought first to be tried that way. The following are generally the results of this experiment:

Calcareous earth or stone, when pure, does not melt by itself, but becomes white and friable, so as to break freely between the fingers; and if suffered to cool, and then mixed with water, it becomes hot, like quicklime. As in these experiments only very small pieces are used, this last effect is best discovered by putting the proof on the outside of the hand, with a drop of water to it, when instantly a very quick heat is felt on the skin. When the calcareous substance is mixed with the vitriolic acid, as in gypsum, or with a clay, as in marl, it commonly melts by itself, yet with more or less difficulty in proportion to the differences of the mixtures. Gypsum produces generally a white, and marl a gray, glass or slag. When there is any iron in it, as a white iron ore, it becomes dark, and sometimes quite black, &c.

The siliceæ never melt alone, but become generally more brittle after being burnt. Such of them as are colored become colorless, and the sooner when it does not arise from any contained metal; for instance, the topazes, amethysts, &c., some of the precious stones, however, excepted; and such as are mixed with iron grow dark in the fire, as some of the jaspers, &c.

The garnets melt always into a black slag, and sometimes so easily that they may be brought into a round globule upon the charcoal.

The argillaceæ, when pure, never melt, but become white and hard. The soap-rock is easily cut with a knife; but, being burnt, it cuts glass, and would strike fire with steel, if as large a piece as is necessary for that purpose could be tried in this way. The soap rocks are sometimes found of a dark brown, and nearly black color, but nevertheless become quite white in the fire. But care must be taken not to urge the flame from the top of the wick, there being for the most part a sooty smoke, which will darken all that it touches; and, if this be not observed, a mistake in the experiment may happen. But if it is mixed with

iron, as it sometimes is, it does not so easily part with its dark color. The argillaceæ, when mixed with lime, melt by themselves. When mixed with iron, as in the boles, they grow dark or black; and, if the iron is not in too great a quantity, they melt alone into a dark slag; the same happens when they are mixed with iron and the vitriolic acid, as in the common clay, &c.

Mica and asbestos become somewhat hard and brittle in the fire, and are more or less refractory, though they give some marks of fusibility.

The fluors discover one of their chief characteristics by giving a light like phosphorus in the dark, when they are slowly heated; but lose this property, as well as their color, as soon as they are made red hot. They commonly melt in the fire into a white opaque slag, though some of them not very easily.

Some sorts of the zeolites melt easily, and foam in the fire, sometimes nearly as much as borax, and become a frothy slag, &c.

Many of those mineral bodies which are impregnated with iron, as the boles, and some of the white iron ores, &c., as well as some of the other iron ores, viz. the bloodstone, are not attracted by the loadstone before they have been thoroughly roasted, &c.

After the minerals have been tried in the fire by themselves, they ought to be heated with fluxes, to discover if they can be melted or not, with some other phenomena attending this operation. For this purpose, three different kinds of salts are used as fluxes, viz. soda, borax, and sal fusibile microcosmicum. See FLUX.

The soda is, however, not much used in these small experiments, its effects upon the charcoal rendering it, for the most part, unfit for it; because, as soon as the flame begins to act upon it, it melts instantly, and is almost wholly absorbed by the charcoal. When this salt is employed to make any experiment, a very little quantity is wanted at once, viz. about the cubical contents of an eighth part of an inch. This is laid upon the charcoal, and the flame blown on it with the blow-pipe; but, as this salt commonly is in form of a powder, it is necessary to go on very gently, that the force of the flame may not disperse the minute particles of the salt. As soon as it begins to melt, it runs along on the charcoal, almost like melted tallow; and when cold it is a glassy matter, of an opaque dull color, spread on the coal. The moment it is melted, the matter which is to be tried ought to be put into it, as otherwise the greatest part of the salt will be soaked into the charcoal, and too little of it left for the intended purpose. The flame ought then to be directed on the matter itself; and if the salt spreads too much about, leaving the proof almost alone, it may be brought to it again by blowing the flame on its extremities, and directing it towards the subject of the experiment. In the assays made with this salt, we may find whether the mineral bodies which are melted with it have been dissolved by it or not; but we cannot tell with any certainty whether this is done hastily and with force, or gently and slow; nor whether a less or a greater part of the matter has been dissolved; neither can it be well distinguished if the matter has imparted any weak tincture to the slag; because this salt always bubbles upon the charcoal during the experiment, nor is it clear when cool; so that scarcely any color, except a very deep one, can be discovered; although it may sometimes be colored by the matter that has been tried.

In the following lists, the articles marked † effervesce very little; those marked ‡ not at all; those marked * require a larger quantity of the flux and a longer continuance of heat than the rest; those marked || are more difficultly dissolved than the others.

The following earths are entirely soluble in soda, with effervescence:—agate, chalcedony, carnelian, Turkey stone †, fluor minerals †, onyx, opal, quartz, common flint, ponderous spar. The following are divisible in it, with or without effervescence, but not entirely soluble:—amianthus, asbestos, basaltes, chrysolite ‡, granate ‡, horn-blende, jasper, marl-stone, mica, the mineral of alum from Tolfa, petrosilex, aluminous slate and roof-slate from Helsingia, emeralds, steatites, common flint, schorl, talc, trapp, tripoli, tourmalin. And the following are neither fusible nor divisible in it:—diamond, hyacinth, ruby, sapphire, topaz.

The other two salts, viz. borax and the sal microcosmicum, are very well adapted to these experiments, because they may by the flame be brought to a clear, uncolored, and transparent glass; and, as they have no attraction to the charcoal, they keep themselves always upon it in a round globular form. The sal fusibile microcosmicum is very scarce; it is made of urine.

The following earths are soluble in borax, with more or less effervescence:—Fluor minerals †, marl, mica † the mineral of alum from Tolfa, aluminous slate and roof-slate from Helsingia †, ponderous spar, schorl, talc †, tourmalin. And the following without effervescence:—Agate, diamond, amianthus, asbestus, basaltes, chalcedony, carnelian, chrysolite, Turkey-stone, granate, hyacinth *, jasper, lapis ponderosus, onyx, opal, petrosilex, quartz *, ruby, sapphire, common flint *, steatites, trapp, trippel, or tripoli topaz, zeolite, hydrophanes.

In the microcosmic salt, the following are soluble, with more or less effervescence:—Basaltes †, Turkey-stone ‡, fluor mineralis †, marl, mica, the mineral of alum from Tolfa, schistus aluminaris, schistus tegularis from Helsingia †, schorl, spathum ponderosum, tourmalin †, lapis ponderosus; and the following without visible effervescence:—Agate, diamond, amianthus, asbestus, chalcedony, carnelian, chrysolite, granate, hyacinth, jasper, onyx ||, opal, petrosilex, quartz ||, ruby, sapphire, common flint ||, emerald, talc, topaz, trapp, trippel, zeolite, horn-blende, hydrophanes, lithomarga, steatites.

Calcareous earth, ponderous spar, gypsum, and other additaments, often assist the solution both in the microcosmic salt and in borax. To observe the effervescence properly, the matter added to the flux should be in the form of a small particle rather than in fine powder; because in this last there is always air between the particles, which, being afterwards driven off by the heat, afford the appearance of a kind of effervescence

The quantity of these two salts required for an experiment is almost the same as the soda; but as the former are crystallised, and consequently include a great deal of water, particularly the borax, their bulk is considerably reduced when melted, and therefore a little more of them may be taken.

Both these salts, especially the borax, when exposed to the flame of the blow-pipe, bubble very much, and foam, before they melt to a clear glass, which for the most part depends on the water they contain. And as this would hinder the assayer from making due observations on the phenomena of the experiment, the salt which is to be used must first be brought to a clear glass, before it can serve as a flux; it must, therefore, be kept in the fire until it become so transparent that the cracks in the charcoal may be seen through it. This done, whatsoever is to be tried is put to it, and the fire continued.

For the assays made with any of these two fluxes on mineral bodies, no larger pieces must be taken than that altogether they may keep a globular form upon the charcoal; as it may then be better distinguished in what manner the flux acts upon the matter during the experiment. If this be not observed, the flux, communicating itself with every point of the surface of the mineral body, spreads all over it, and keeps the form of this last, which commonly is flat, and thus hinders the operator from observing all the phenomena. Besides, the flux being in too small a quantity, in proportion to the body to be tried, will be too weak to act with all its force upon it. The best proportion, therefore, is about a third part of the mineral to the flux; and as the quantity of the flux above mentioned makes a globe of a due size, in regard to the greatest heat that is possible to procure in these experiments, so the size of the mineral must be a third part less here than when it is to be tried in the fire by itself. Soda is not of much use in these experiments; nor has it any particular qualities, in preference to the two last-mentioned salts, except that it dissolves the zeolites easier.

The microcosmic salt shows almost the same effects in the fire as the borax, only differing from it in a very few circumstances; of which one of the principal is, that, when melted with manganese, it becomes of a crimson hue, instead of a jacinth color, which borax takes. This salt is, however, from its scarcity, still very little in use, borax being commonly employed. Whenever a mineral body is melted with any of these two salts, it is easily seen, whether it quickly dissolves; in which case an effervescence arises, that lasts till the whole be dissolved; whether the solution be slowly performed, in which case few and small bubbles only rise from the matter; or, whether it can be dissolved at all; because, if not, it is observed only to turn round in the flux, without the least bubble, and the edges look as sharp as before.

To illustrate farther these experiments, we shall give a few examples of the effects of borax upon the mineral bodies. The calcareous substances, and all those stones which contain lime, dissolve readily and with effervescence in the borax. The effervescence is the more violent, the greater the portion of the lime contained in the stone. This cause, however, is not the only one in the gypsum, because both the constituents of this readily mix with the borax, and therefore a greater effervescence arises in melting gypsum with the borax than lime alone. The siliceæ do not dissolve, some few excepted, which contain a quantity of iron. The argillaceæ, when pure, are not acted upon by the borax; but, when mixed with some heterogeneous bodies, they are dissolved, though very slowly; such are the stone marrow, common clay, &c. The granates, zeolites, and trapp, dissolve but slowly. The fluors, asbestinæ, micaceæ, dissolve for the most part very easily. Some of these bodies melt to a colorless transparent glass with the borax; for instance, the calcareous substances, when pure, the fluors, some of the zeolites, &c. Others tinge the borax with a green transparent color, viz. the granates, trapp, some of the argillaceæ, and some of the micaceæ and asbestinæ.

Borax can only dissolve a certain proportional quantity of the mineral. Of the calcareous kind it dissolves a vast quantity; but turns at last, when too much has been added, from a clear transparent to a white opaque slag. When the quantity of the calcareous matter exceeds but little in proportion, the glass looks very clear as long as it remains hot; but, as soon as it begins to cool, a white half-opaque cloud is seen to arise from the bottom, which spreads over the third, half, or more of the glass globe, in proportion to the quantity of calcareous matter; but the glass or slag is nevertheless shining, and of a glassy texture when broken. If more of this matter be added, the cloud rises quicker and is more opaque, and so by degrees till the slag becomes quite milk white. It is then no more of a shining, but rather dry appearance on the surface; is very brittle, and of a grained texture when broken.

Of the analysis of metals and ores.—In examining metals and ores an exact knowledge and nicety of procedure are the more necessary, that the metals are often so disguised in their ores, as to be very difficultly known by their external appearance, and liable sometimes to be mistaken one for the other:—some of the cobalt ores, for instance, resemble much the pyrites arsenicalis; there are also some iron and lead ores which are very like one another, &c.

As the ores generally consist of metals mineralised with sulphur or arsenic, or sometimes both, they ought first to be exposed to the fire by themselves, not only to determine with which of these they are mineralised, but also to set them free from those volatile mineralising bodies: this serves instead of calcination, by which they are prepared for further assays. Whenever any metal or fusible ore is to be tried, a little concavity must be made in that part of the charcoal where the matter is to be put; to prevent it from rolling off. When an ore is to be tried, a small bit is laid upon the charcoal, and the flame blown on it slowly. Then the sulphur or arsenic begins to part from it in form of smoke; these are easily distinguished by their smell; that of sulphur being sufficiently known, and the arsenic smelling like garlick. The flame ought to be

blown very gently as long as any smoke is seen to part from the ore; but, after that, the heat must be augmented by degrees, to make the calcination as perfect as possible. If the heat be applied very strongly from the beginning, upon an ore that contains much sulphur or arsenic, the ore will presently melt, and yet lose very little of its mineralising bodies; thus rendering the calcination very imperfect. It is, however, impossible to calcine the ores in this manner to the utmost perfection, which is easily seen in melting down a calcined potter's ore with borax, as it will bubble upon the coal, which depends on the sulphur still left, the vitriolic acid of this uniting with the borax, and causing this motion. However, lead in its metallic form, melted in this manner, bubbles upon the charcoal, if any sulphur remains in it. But as the lead, as well as some of the other metals, may raise bubbles upon the charcoal although they are quite free from the sulphur, only by the flames being forced too violently on it, these phenomena ought not to be confounded with each other.

The ores being thus calcined, the metals contained in them may be discovered, either by being melted alone or with fluxes; when they show themselves, either in their pure metallic state or by tinging the slag with a color peculiar to each of them. In these experiments it is not to be expected that the quantity of metal contained in the ore should be exactly determined; this must be done in larger laboratories. This cannot, however, be looked upon as any defect, since it is sufficient for a mineralogist to find out what sort of metal is contained in the ore. There is another and a more real defect in the miniature laboratories, viz. that some ores are not at all capable of being tried by so small an apparatus; for instance, the gold ore called pyrites aureus, which consists of gold, iron, and sulphur. The greatest quantity of gold which this ore contains is about one ounce, or one ounce and a half, out of 100 pounds of the ore, the rest being iron and sulphur: and, as only a very small oit is allowed for these experiments, the gold contained therein can hardly be discerned by the eye, even if it could be extracted; but it goes along with the iron in the slag, this last metal being in so large a quantity in proportion to the other, and both of them having an attraction for each other.

The blendes and black jacks, which are mineral zinc ores, containing zinc, sulphur, and iron, cannot be tried this way, because they cannot be perfectly calcined, and besides the zinc flies off when the iron scorifies. Neither can those blendes which contain silver or gold, mineralised with them, be tried in this manner, which is particularly owing to the imperfect calcination. Nor are the quicksilver ores fit for these experiments; the volatility of that metal making it impossible to bring it out of the poorer sort of ores; and the rich ores, which sweat out the quicksilver when kept close in the hand, not requiring any of these assays. These ores ought to be assayed in larger quantities, and by such other methods as cannot be used upon a piece of charcoal. Some of the rich silver ores are easily tried; e.g. minera argenti vitrea, or silver glass, which consists only of silver and sulphur. When this ore is exposed to the flame, it melts instantly, and the sulphur flies off in fumes, leaving the silver pure upon the charcoal in a globular form. If this silver should be of a dirty appearance, which often is the case, it must be melted anew with a very little borax; and after it has been kept in fusion for a minute or two, so as to be perfectly melted and red-hot, suffered to cool, it may then be taken off the coal, and, being laid upon the steel plate, the silver is separated from the slag by one or two strokes of the hammer. The brass ring ought first to be placed upon the plate, to hinder the proof from flying off by the violence of the stroke, which otherwise would happen. The silver is then found enclosed in the slag of a globular form, and quite shining, as if it was polished. When a large quantity of silver is contained in a lead ore, viz. in a potter's ore, it can likewise be discovered by the blow-pipe.

Tin may be melted out of the pure tin ores in its metallic state. Some of these ores melt very easily, and yield their metal, if only exposed to the fire by themselves: but others are more refractory; and, as these melt very slowly, the tin, which sweats out in form of very small globules, is instantly burnt to ashes before these globules have time to unite and compose a larger globe, which might be seen by the eye, and not so soon destroyed by the fire; it is therefore necessary to add a little borax to these from the beginning, and then to blow the flame violently at the proof. The borax preserves the metal from being too soon calcined, and even contributes to the readier collecting of the small metallic particles, which soon form a globule of metallic tin at the bottom of the whole mass, nearest to the charcoal. As soon as so much of the metallic tin is produced as is sufficient to convince the operator of its presence, the fire ought to be discontinued, though the whole ore be not yet melted; because the whole of this kind of ore can seldom or never be reduced into metal by these experiments, a great proportion being always calcined: and, if the fire is continued too long, even the metal already reduced may be burnt; for tin is very soon deprived of its metallic state by fire.

Most of the lead ores may be reduced to a metallic state upon the charcoal. The mineræ plumbi calciformes, which are pure, are easily melted into lead; but such of them as are mixed with an ochra ferri, or any kind of earth, as clay, lime, &c., yield very little lead, and even none at all, if the heterogenea are combined in any large quantity. These therefore are not to be tried but in larger laboratories. However, every mineral suspected to contain any metallic substance may be tried by the blow-pipe, so as to give sufficient proofs whether it contain any or not, by its effects being different from those of the stones or earths, &c.

The mineræ plumbi mineralisitæ leave the lead in a metallic form, unless too large a quantity of iron is mixed with it. When a tessellated or steel-grained lead ore is exposed to the flame, its sulphur, and even the arsenic, if there be any, begins to fume, and the ore itself to melt into a globular form; the rest of the sulphur continues

then to fly off, if the flame be blown slowly upon the mass; but, on the contrary, very little of the sulphur will go off, if the flame be forced violently on it: in this case, the lead crackles and dissipates, throwing about every minute metallic particles. The sulphur being driven out as much as possible, which is known by finding no sulphureous vapor in smelling at the proof; the whole is suffered to cool, and then a globule of metallic lead will be left upon the coal. If any iron is contained in the ore, the lead, which is melted out of it, is not of a metallic shining, but rather of a black and uneven surface: a little borax must in this case be melted with it; and, as soon as no bubble is seen to rise any longer from the metal into the borax, the fire must be discontinued: when the mass is grown cold, the iron will be found scorified with the borax, and the lead left pure and of a shining color. Borax does not scorify the lead in these small experiments when it is pure; if the flame is forced with violence on it, a bubbling will ensue, resembling that which is observed when borax dissolves a body melted with it; but, when the fire ceases, the slag will be perfectly clear and transparent, and a quantity of very minute particles of lead will be seen spread about the borax, which have been torn off from the mass during the bubbling.

If such a lead ore is rich in silver, this last metal may likewise be discovered by this experiment; because, as the lead is volatile, it may be forced off, and the silver remain. To effect this, the lead, which is melted out of the ore, must be kept in constant fusion with a slow heat, that it may be consumed. This end will be sooner obtained, and the lead part quicker, if during the fusion the wind through the blow-pipe be directed immediately, but not forcibly, upon the melted mass, until it begin to cool; when the fire must be directed on it again. The lead, already in a volatilising state, will thus be driven out in form of a subtile smoke; and by thus continuing by turns to melt the mass, and blow off the lead, until no smoke is perceived, the silver will at last be obtained pure. As only very little bits of ores can be employed in these experiments, it will be difficult to extract the silver out of a poor ore, for some part of it will fly off with the lead, and what might be left is too small to be discerned by the eye. The silver thus obtained is easily distinguished from lead by the following marks: it must be red-hot before it can be melted, it cools sooner than lead; it is brighter and whiter than lead; and harder under the hammer.

The mineræ cupri calciformes, at least some of them, when not mixed with too much stone or earth, are easily reduced to copper with any flux; if the copper has not its natural bright color, it must be melted with a little borax, which purifies it. Some of these ores do not discover their metal, if not immediately melted with borax; the heterogenea contained in them hindering the fusion before these are scorified by the flux.

The gray copper ores, which only consist of copper and sulphur, are tried almost in the same manner. Being exposed to the flame by themselves, they instantly melt, and part of their sulphur goes off. The copper may afterwards be obtained in two ways: the one, by keeping the proof in fusion for about a minute, and afterwards suffering it to cool; when it will be found to have a dark and uneven appearance externally, but which, after being broken, discovers the metallic copper of a globular form in its centre, surrounded with a regulus, which still contains some sulphur and a portion of the metal; the other by being melted with borax, which last way sometimes makes the metal appear sooner.

The mineræ cupri pyritaceæ, containing copper, sulphur, and iron, may be tried with the blow-pipe if they are not too poor. In these experiments the ore ought to be calcined, and after that the iron scorified. For this purpose a bit of the ore must be exposed to a slow flame, that as much of the sulphur as possible may part from it before it is melted, because the ore commonly melts very soon, and then the sulphur is more difficultly driven off. After being melted, it must be kept in fusion with a strong fire for about a minute, that a great part of the iron may be calcined; and, after that, some borax must be added, which scorifies the iron, and turns with it to a black slag. If the ore is very rich, metallic copper will be had in the slag after the scorification. If the ore be of a moderate richness, the copper will still retain a little sulphur, and sometimes iron: the product will therefore be brittle, and must with great caution be separated from the slag, that it may not break into pieces; and, if this product is afterwards treated in the manner above described of the gray copper ores, the metal will soon be produced. But, if the ore is poor, the product, after the first scorification, must be brought into fusion, and afterwards melted with some fresh borax, to calcine and scorify the remaining portion of iron; after which it may be treated as mentioned in the last paragraph. The copper will in this case be found in a very small globule.

The copper is not easily scorified with this apparatus, when it is melted with borax, unless it has first been exposed to the fire by itself to be calcined. When only a little of this metal is dissolved, it instantly tinges the slag of a reddish-brown color, and mostly opaque; but as soon as this slag is kept in fusion for a little, it becomes quite green and transparent: and thus the presence of the copper may be discovered by the color, when it is concealed in heterogeneous bodies, so as not to be discovered by any other experiment. If metallic copper is melted with borax by a slow fire, and only for a very little time, the slag becomes of a fine transparent blue or violet color, inclining more or less to green: but this color is not entirely owing to the copper, because the same color is to be had in the same manner from iron; and those glasses which are colored with either of these metals soon lose their color if exposed to a strong fire, and become quite clear. Besides, if this glass, tinged blue with the copper, is again melted with more of this metal, it becomes of a good green color, which remains long unchanged in the fire.

The iron ores, when pure, can never be melted, per se by the blow-pipe alone; nor do they yield their metal when melted with fluxes: because they require too strong a heat to be brough

into fusion; and both the ore and the metal are very soon calcined. This easy calcination is also the reason why the fluxes readily scorify this ore, and even the metal itself. The iron is more easily scorified than the copper. The iron is, however, discovered without much difficulty, although it were mixed but in a very small quantity with neterogeneous bodies. The ores are all attracted by the loadstone, some without any previous calcination, and others without being roasted. When a clay is mixed with a little iron, it commonly melts by itself in the fire; but, if iron is contained in a limestone, it does not promote the fusion, but gives the stone a dark and sometimes a deep black color, which is always the character of iron. A minera ferri calciformis pura crystallisata is commonly of a red color: This, being exposed to the flame, becomes quite black; and is then readily attracted by the loadstone, which it was not before. Besides these signs, iron is discovered by tinging the slag of a green transparent color, inclining to brown, when only a little of the metal is scorified; but, as soon as any large quantity thereof is dissolved in the slag, this becomes first a blackish-brown, and afterwards quite black and opaque.

Bismuth is known by its communicating a yellowish brown color to borax; and arsenic by its volatility and garlick smell.

Antimony, both in form of regulus and ore, is wholly volatile in the fire when it is not mixed with any other metal except arsenic; and is known by its particular smell, easier to be distinguished than described. When the ore of antimony is melted upon the charcoal, it bubbles constantly during its volatilising.

Zinc ores are not easily tried upon charcoal but the regulus of zinc exposed to the fire upon it burns with a beautiful blue flame, and forms itself almost instantly into white flowers, called flowers of zinc.

Cobalt is remarkable for giving to the glass a blue color, which is the zaffre or smalt. To produce this, a piece of cobalt ore must be calcined in the fire, and afterwards melted with borax. As soon as the glass, during the fusion, from being clear, grows opaque, it is a sign that it is tinged a little; the fire is then to be discontinued, and the operator must take hold, with the nippers, of a little of the glass, whilst yet hot, and draw it out slowly in the beginning, but afterwards very quickly, before it cools, whereby a thread of the colored glass is procured, more or less thick, wherein the color may easier be seen than in a globular form. This thread melts easily, if only put in the flame of the candle without the help of the blow-pipe. If this glass be melted again with more of the cobalt, and kept in fusion for a while, the color becomes very deep; and thus the color may be varied at pleasure. When the cobalt ore is pure, or contains but little iron, a cobalt regulus is almost instantly produced in the borax during the fusion; but, when it is mixed with a quantity of iron, this last metal ought first to be separated, which is easily performed, as it scorifies sooner than the cobalt; therefore, as long as the slag retains any brown or black color, it must be separated, and melted again with fresh borax, until it shows the blue color.

Nickel is very seldom to be had; and as its ores are seldom free from mixtures of other metals, it is very difficultly tried with the blow-pipe. However, when mixed with iron and cobalt, it is easily freed from these heterogeneous metals, and reduced to a pure nickel regulus by scorification with borax, because both the iron and cobalt sooner scorify than the nickel. The regulus or nickel itself is of a green color when calcined: it requires a pretty strong fire before it melts, and tinges the borax with a hyacinth color. Manganese gives the same color to borax; but its other qualities are quite different, so as not to be confounded with the nickel.

When those ores are to be reduced whose metals are very easily calcined, as tin, zinc, &c., it may be of service to add hard resin, as the charcoal cannot afford enough of it in the open fire of these assays. The manner of melting the volatile metals out of their ores per descensum might also be imitated: for instance, a hole might be made in the charcoal, wide above and very narrow at the bottom; a little piece of the ore being then laid at the upper end of the hole, and covered with some very small pieces of the charcoal, the flame must be directed on the top; the metal might thus run into the hole below, concealed from the violence of the fire, particularly if the ore is very fusible.

The use of the apparatus above referred to, and which may be called a pocket laboratory, as the whole admits of being packed into a small case, is chiefly calculated for a travelling mineralist. But a person who always resides at one place may make it more commodious to himself, and avoid the trouble of blowing with the mouth. For this purpose he may have the blowpipe go through a hole in a table, and fixed underneath to a small pair of bellows with double bottoms, such as some of the glass-blowers use, and then nothing more is required than to move the bellows with the feet during the experiment; in this case a lamp may be used instead of a candle. It would only be necessary to observe that, in proportion as the nozzle of the pipe is enlarged, the quantity of the flame must be augmented by a thicker wick in the lamp, and the force of blowing increased by weights laid on the bellows; a much intenser heat would thus be produced by a pipe of considerable opening at the end, by which the experiments must undoubtedly be carried farther than by the common blowpipe.

A traveller, who has seldom an opportunity of carrying many things along with him, will find this laboratory and its apparatus sufficient for most experiments that can be made on a journey. He should also have a little box including the different acids, and one or two matrasses to try mineral bodies in liquid menstrua. These are, the acids of nitre, of vitriol, and of common salt. Most of the stones and earths are attacked, at least in some degree, by the acids; but the calcareous are the easiest of all to be dissolved by them. The acid of nitre is that which is most used in these experiments; it dissolves the limestone, when pure, perfectly, with a violent effervescence, and the solution becomes clear: when the limestone enters into some other body, it is

nevertheless discovered by this acid, through a greater or less effervescence in proportion to the quantity of the calcareous particles, unless there are so few as to be almost concealed from the acid by the heterogeneous ones. A calcareous body, which nearly resembles a siliceous or argillaceous one, may be thus known from these latter, without the blow-pipe, merely by pouring one or two drops of this acid upon it; which is very convenient, when there is neither opportunity nor time to use this instrument.

The gypsa, which consist of lime and the vitriolic acid, are not in the least attacked by the acid of nitre, if they contain a sufficient quantity of their own acid; because the vitriolic acid has a stronger attraction to the lime than the acid of nitre; but, if the calcareous substance is not perfectly saturated with the acid of vitriol, then an effervescence arises with the acid of nitre, more or less in proportion to the want of the vitriolic acid. These circumstances are often very essential in distinguishing the calcarea and gypsa.

The acid of nitre is likewise necessary in trying the zeolites, of which some species have the singular effect to dissolve with effervescence in this acid; and within a quarter of an hour, though sometimes not until several hours after, to change the whole solution into a clear jelly, of so firm a consistence that the glass wherein it is contained may be inverted without its falling out. If any mineral body is tried in this menstruum, and only a small quantity is suspected to be dissolved, though it was impossible to distinguish it with the eye during the solution, it can be easily discovered by adding to it ad saturitatem a clear solution of the alkali, when the dissolved part will be precipitated, and fall to the bottom. For this purpose the soda is very useful. The acid of nitre will suffice for making experiments upon stones and earths; but, if the experiments are to be extended to the metals, the other two acids are also necessary.

Another instrument is also necessary to a complete Pocket Laboratory, viz. a washing trough in which the mineral bodies, and particularly the ores, may be separated from each other, and from the adherent rock, by water. This trough is very common in laboratories, and is used of different sizes; but here only one is required of a moderate size, such as twelve inches and a half long, three inches broad at one end, and one inch and a half at the other end, sloping down from the sides and the broad end to the bottom, where it is three-quarters of an inch deep. It may, however, be made of much smaller dimensions. It is commonly made of wood, which ought to be chosen smooth, hard, and compact, wherein are no pores in which the minute grains of the pounded matter may lie concealed. If any such matter is to be washed as is suspected to contain some native metal, such as silver or gold, a trough should be procured for this purpose of a very shallow slope, because the minute particles of the native metal have then more power to assemble together at the broad end, and separate from the other matter.

The management of this trough, or the manner of washing, is this:—When the matter is mixed with about three or four times its quantity of water in the trough, this is kept very loose between two fingers of the left hand, and some light strokes given on its broad end with the right, that it may move backwards and forwards; by which means the heaviest particles assemble at the broad and lower end, from which the lighter ones are to be separated by inclining the trough, and pouring a little water on them. By repeating this process all such particles as are of the same gravity may be collected together, and separated from those of different gravity, provided they were before equally pounded: though such as are of a clayey nature are often very difficult to separate from the rest, which, however, is of no great consequence to a skilful and experienced washer. The washing process is very necessary, as there are often rich ores, and even native metals, found concealed in earths and sand in such minute particles as not to be discovered by any other means.

For performing experiments in the humid way the chief articles (and which must be kept in a separate case) are, a collection of phials, containing the principal acids, tests, precipitants, and re-agents, both for examining mineral bodies by the humid way, and for analysing the various kinds of mineral waters. Those with acids and corrosive solutions have not only ground stopples, but also an external cap to each, bound over the stopple, and secured downward by a bit of wax between both to confine the corrosive and volatile fluids. But those which contain mild fluid liquors do not need such external caps: and those with dry inoffensive substances are only stopped with corks. There are also two smaller cylindrical phials to exhibit the changes of color produced by some of the re-agents in those analytical assays. There are also two or three small mattrasses to hold the substances with their solvents over the fire; a small glass funnel for pouring the fluids; a small porcelain mortar, with its pestle; one or two crucibles of the same substance; a small wooden trough to wash the ground ores; some glass sticks to stir up the fluid mixtures; and, finally, pieces of paper tinged red, yellow, and blue, by the tinctures of Fernambuc wood (commonly called Brasil wood), turmeric, and litmus, thickened with a little starch.

The lamp furnace laboratory, for experiments both by the humid and the dry way, is a very curious and useful; though small apparatus. It is an improvement of one contrived by M. Morveau, in consequence of the information he received from his friend the president de Virly, who saw at Upsal how advantageously the late eminent Sir T. Bergman availed himself of this convenience for many analytical processes in miniature, by the use of very small glass vessels about an inch diameter, and other implements of proportional size, for performing various chemical operations.

When these processes are properly conducted, though in miniature, the lamp furnace will prove amply sufficient to perform, in a few minutes, and with very little expense, the various solutions, digestions, and distillations, which otherwise would require large vessels, stills, retorts, reverberatory furnaces, &c., to ascertain the con-

ponent parts of natural bodies; though it is not always sufficient to ascertain their respective quantities. In this last case operations must be performed in great laboratories, and on a large scale, at a considerable expense. But the substances are sometimes too valuable; for instance, when precious stones are to be examined, the last way never can be attempted.

These small processes have likewise another advantage which cannot be obtained in large works, viz. that one can observe the gradual progress of each operation; retard or urge it, as it may require; and ascertain at pleasure each step of every experiment, with the phenomena attending it. See CHEMISTRY.

Before a mineral is submitted to analysis it ought to be reduced to an impalpable powder. This is by no means an easy task when the stone is extremely hard. It ought to be raised to a bright red or white heat in a crucible, and then instantly thrown into cold water. This sudden transition makes it crack and break into pieces. If these pieces are not small enough the operation must be repeated on each, till they are reduced to the proper size. These fragments are then to be beaten to small pieces in a polished steel mortar; the cavity of which should be cylindrical, and the steel pestle should fit it exactly to prevent any of the stone from escaping during the act of pounding. As soon as the stone is reduced to pretty small pieces it ought to be put into a mortar of rock crystal, or flint, and reduced to a coarse powder. This mortar should be about four inches in diameter, and rather more than an inch in depth. The pestle should be formed of the same stone with the mortar.

When the stone has been reduced to a coarse powder, a certain quantity, weighing exactly 100 grains for instance, ought to be reduced to as fine a powder as possible. This is best done by pounding small quantities of it at once, not exceeding ten grains. The powder is as fine as possible when it feels soft, adheres together, and as it were forms a cake under the paste. It ought then to be weighed exactly. It will almost always be found heavier after being pounded than it was before, owing to a certain quantity of the substance of the mortar being rubbed off during the grinding, and mixed with it. This additional weight must be carefully noted; and, after the analysis, a portion corresponding to it must be subtracted.

It is necessary to have a crucible of pure silver, or, what is far preferable, of platinum, capable of holding rather more than seven cubic inches of water, with a cover of the same metal; and a spatula of the same about four inches long. The dishes in which the solutions, evaporations, &c., are performed ought to be of glass or porcelain. Those of porcelain are cheaper because they are not so apt to break. Those which Vauquelin uses are of porcelain; they are sections of spheres, and are glazed both within and without, except that part of the bottom which is immediately exposed to the fire.

Let 100 or 200 grains of the stone to be analysed, previously reduced to a fine powder, be mixed with three times its weight of pure potass and a little water, and exposed in the silver or platinum crucible to a strong heat. The heat should at first be applied slowly, and the matter should be constantly stirred to prevent the potass from swelling and throwing any part out of the crucible. When the whole water is evaporated the mixture should be kept for half an hour or three-quarters in a strong red heat.

If the matter in the crucible melts completely, and appears as liquid as water, we may be certain that the stone consists chiefly of silica; if it remains opaque, and of the consistence of paste, the other earths are most abundant; if it remains in the form of a powder alumina is the prevalent earth. If the matter be of a dark or brownish-red color it contains oxide of iron; if it is grass green, manganese is present; if yellowish green, chromum. When the crucible has been taken from the fire, and wiped on the outside, it is to be placed in a capsule of porcelain, and filled with water. This water is to be renewed from time to time, till all the matter is detached from the crucible. The water dissolves a part of the combination of the alkali with the silica and alumina of the stone; and, if a sufficient quantity were used, it would dissolve the whole of that combination.

Muriatic acid is now to be poured in till the whole of the matter is dissolved. At first a flaky precipitate appears, because the acid combines with the alkali which kept it in solution. Then an effervescence takes place, owing to the decomposition of some carbonate of potass, formed during the fusion. At the same time the flaky precipitate is redissolved; as is also that part of the matter which, not having been dissolved in the water had remained at the bottom of the dish in the form of a powder. This powder, if it consists only of silica and alumina, dissolves without effervescence; but, if it contains lime, an effervescence takes place. If this solution be colorless, we may conclude that it contains no metallic oxide, or only a very small portion; if the color be purplish red, it contains manganese; orange red indicates the presence of iron; and golden yellow that of chromum.

This solution is to be poured into a capsule of porcelain, covered with paper, and evaporated to dryness in a sand bath. When the evaporation is drawing to its completion, the liquor assumes the form of jelly. It must then be stirred constantly with a glass or porcelain rod, to facilitate the disengagement of the acid and water, and to prevent one part of the matter from being too much and the other not sufficiently dried. Without this precaution the silica and alumina would not be completely separated from each other.

When the matter is reduced almost to a dry powder, a large quantity of pure water is to be poured on it; and, after exposure to a slight heat, the whole is to be poured on a filter. The powder which remains on the filter is to be washed repeatedly, till the water with which it has been washed ceases to precipitate silver from its solutions. This powder is the whole of the silica which the stone we are analysing contained. It must first be dried between folds of blotting paper; then heated red hot in a platinum c

weighed while yet warm. It ·vder, of a white color, not and entirely soluble in ·is contaminated with ws that the evapo- ned at too high oxide the silica nd then washed d solution must be passed through the denominate A.

is to be evaporated till xceed thirty cubic inches, n pint. A solution of car- s then to be poured into it, till precipitates. It ought to be minutes to enable all the precipitate bottom. When the whole of the pre- as collected at the bottom, the superna- uid is to be decanted off; and, water being tuted in its place, the precipitate and water to be thrown upon a filter. When the water has run off, the filter, with the precipitate upon it, is to be placed between folds of blotting paper. When the precipitate has acquired some consistence, it is to be carefully collected by an ivory knife, mixed with a solution of pure potass, and boiled in a porcelain capsule. If any alumina or glucina be present, they will be dissolved in the potass; while the other substances remain untouched in the form of a powder, which we shall call B.

Into the solution of potass as much acid must be poured as will not only saturate the potass, but completely redissolve any precipitate which may have at first appeared. Carbonate of ammonia is now to be added in such quantity that the liquid shall taste of it. By this addition the whole of the alumina will be precipitated in white flakes, and the glucina will remain dissolved, provided the quantity of carbonate of ammonia used be not too small. The liquid is now to be filtered; and the alumina, which will remain on the filter, is to be washed, dried, heated red hot, and then weighed. To see if it be really alumina, dissolve it in sulphuric acid, and add a sufficient quantity of sulphate or acetate of potass; if it be alumina, the whole of it will be converted into crystals of alum.

Let the liquid, which has passed through the filter, be boiled for some time; and the glucina, if it contains any, will be precipitated in a light powder, which may be dried and weighed. When pure, it is a fine, soft, very light, tasteless powder, which does not concrete when heated, as alumina does.

The residuum B may contain lime, magnesia, and one or more metallic oxides. Let it be dissolved in weak sulphuric acid, and the solution evaporated to dryness. Pour a small quantity of water on it. The water will dissolve the sulphate of magnesia and the metallic sulphate; but the sulphate of lime will remain undissolved. Let it be heated red-hot in a crucible and weighed. The lime amounts to 0·42 of the weight. Let the solution, containing the remaining sulphates, be diluted with a large quantity of water; let a small excess of acid be added; and then let a saturated carbonate of potass be poured in. The oxides of chromum, iron, and nickel, will be precipitated, and the magnesia and oxide of manganese will remain dissolved. The precipitate we shall call C.

Into the solution let a solution of hydrosulphuret of potass be poured, and the manganese will be precipitated in the state of a hydrosulphuret. Let it be calcined in contact with air, and weighed. The manganese may then be precipitated by pure potass, washed, exposed to a red heat, and then weighed.

Let the residuum C be boiled repeatedly with nitric acid, then mixed with pure potass; after being heated let the liquid be decanted off. Let the precipitate, which consists of the oxides of iron and nickel, be washed with pure water; and let this water be added to the solution of the nitric acid and potass. That solution contains the chromum converted into an acid. Add to this solution an excess of muriatic acid, and evaporate till the liquid assumes a green color; then add a pure alkali. The chromum precipitates in the state of an oxide, and may be dried and weighed.

Let the precipitate, consisting of the oxides of iron and nickel, be dissolved in muriatic acid; add an excess of ammonia: the oxide of iron precipitates. Let it be washed, dried, and weighed. Evaporate the solution, and the oxide of nickel will also precipitate. Its weight may be ascertained in the same manner with the other ingredients.

The weights of all the ingredients are now to be added together, and their sum total compared with the weight of the matter analysed. If the two are equal, or if they differ only by 0·03 or 0·04 parts, we may conclude that the analysis has been properly performed; but, if the loss of weight be considerable, something or other has been lost. The analysis must therefore be repeated with all possible care. If there be still the same loss of weight, we may conclude that the stone contains some substance, which has either evaporated by heat, or is soluble in water.

A fresh portion of the stone must therefore be broken into small pieces, and exposed in a porcelain crucible to a strong heat. If it contain water, or any other volatile substance, they wil. come over into the receiver; and their nature and weight may be ascertained. If nothing comes over, or if what comes over is not equal to the weight wanting, we may conclude, that the stone contains some ingredient which is soluble in water.

To discover whether it contains potass, let the stone, reduced to an impalpable powder, be boiled five or six times in succession, with very strong sulphuric acid, applying a pretty strong heat towards the end of the operation, to expel the excess of acid; but taking care that it be not strong enough to decompose the salts which have been formed.

Water is now to be poured on, and the residuum, which does not dissolve, is to be washed with water till it becomes tasteless. The watery solution is to be filtered, and evaporated to dryness, in order to drive off any excess of acid which may be present. The salts are to be again

dissolved in water; and the solution, after being boiled for a few moments, is to be filtered and evaporated to a consistence proper for crystallising. If the stone contains a sufficient quantity of alumina, and if potass be present, crystals of alum will be formed; and the quantity of potass may be discovered by weighing them, it being nearly one-tenth of their weight. If the stone does not contain alumina, or not in sufficient quantity, a solution of pure alumina in sulphuric acid must be added. Sometimes the alum, even when potass is present, does not appear for several days or even weeks; and sometimes, when a great quantity of alumina is present, if the solution has been too much concentrated by evaporation, the sulphate of alumina prevents the alum from crystallising at all. Care, therefore, must be taken to prevent this last source of error. The alum obtained may be dissolved in water, and barytic water poured into it as long as any precipitate forms. The liquor is to be filtered and evaporated to dryness. The residuum will consist of potass, and a little carbonate of potass. The potassa may be dissolved in a little water. This solution, evaporated to dryness, gives us the potassa pure; which may be examined and weighed.

If no crystals of alum can be obtained, we must look for some other substance than potassa. The stone may contain soda. The presence of this alkali may be discovered by decomposing the solution in sulphuric acid, already described, by means of ammonia. The liquid which remains is to be evaporated to dryness, and the residuum is to be calcined in a crucible: the sulphate of ammonia will thus be volatilised, and the soda will remain. It may be redissolved in water, crystallised, and examined.

If sulphuric acid does not attack the stone, as is often the case, it must be decomposed by fusion with soda, in the manner formerly directed with potassa. The matter, after fusion, is to be diluted with water, and then saturated with sulphuric acid. The solution is to be evaporated to dryness, the residuum again dissolved in water, and evaporated. Sulphate of soda will crystallise first; and by a second evaporation, if the stone contains potassa and alumina, crystals of alum will be deposited. The presence of potassa may be discovered by mixing with a somewhat concentrated solution of muriate of platinum the salt obtained, either by decomposing the stone immediately by an acid, or by saturating with an acid the matter obtained by fusing the stone with soda. If any potassa be present, a very red precipitate will be formed. This precipitate is a triple salt, composed of potassa, muriatic acid, and oxide of platinum. Ammonia, indeed, produces the same precipitate, but has not hitherto been discovered in stones.

In this manner may simple stones and aggregates be analysed. As to saline stones, their analysis must vary according to the acid which they contain. But almost all of them may be decomposed by one or other of two methods: viz.

I. *Analysis of carbonate of strontian.*—Klaproth analysed this mineral, by dissolving 100 parts of it in diluted muriatic acid: during the solution thirty parts of carbonic acid escaped. The solution crystallised in needles, and, when dissolved in alcohol, burnt with a purple flame. Therefore it contained strontian. He dissolved a grain of sulphate of potassa in six ounces of water, and let fall into it three drops of the muriatic solution. No precipitate appeared till next day. Therefore the solution contained no barytes; for, if it had, a precipitate would have appeared immediately. He then decomposed the muriatic acid solution, by mixing it with carbonate of potassa. Carbonate of strontian precipitated. By the application of a strong heat the carbonic acid was driven off. The whole of the earth which remained was dissolved in water. It crystallised; and, when dried, weighed sixty-nine and a half.

II. *Analyses of sulphate of strontian.*—Vauquelin analysed an impure specimen of this mineral as follows:—on 200 parts of the mineral, diluted nitric acid was poured. A violent effervescence took place, and part of the mineral was dissolved. The undissolved portion, after being heated red hot, weighed 167. Therefore thirty-three parts were dissolved. The nitric solution was evaporated to dryness: a reddish substance remained, which indicated the presence of oxide of iron. This substance was redissolved in water, and some ammonia mixed with it; a reddish precipitate appeared, which, when dried, weighed one, and was oxide of iron. The remainder of the solution was precipitated by carbonate of potassa. The precipitate weighed, when dried, twenty, and possessed the properties of carbonate of lime. Therefore 200 parts of this mineral contain twenty of carbonate of lime, one of oxide of iron, and the remainder of the thirty-three parts he concluded to be water.

The 167 parts, which were insoluble in nitric acid, were mixed with 500 parts of carbonate of potass, and 700 parts of water, and boiled for a considerable time. The solution was then filtered, and the residuum washed and dried. The liquid scarcely effervesced with acids; but with barytes it produced a copious precipitate, totally indissoluble in muriatic acid. Therefore it contained sulphuric acid. The undissolved residuum, when dried, weighed 129 parts. It dissolved completely in muriatic acid. The solution crystallised in needles: when dissolved in alcohol it burnt with a purple flame, and, in short, had all the properties of muriate of strontian. Therefore these 129 parts were carbonate of strontian. Now 100 parts of this carbonate contain 30 of carbonic acid, therefore 129 contain 38·7. Therefore the mineral must contain, in 200 parts, 90·3 of strontian. Now the insoluble residuum of 167 was pure sulphate of strontian; and we have seen that it contained 90·3 of strontian. Therefore the sulphuric acid must amount to 76·7 parts.

Nearly in the same manner as in the first of these examples, may the analysis of carbonate of lime and barytes be performed; and nearly in the same manner with the second may we analyse the sulphates of lime and barytes.

Phosphate of lime may be dissolved in muriatic acid, and the lime precipitated by sulphuric

acid, and its quantity ascertained by decomposing the sulphate of lime contained. The liquid solution may be evaporated to the consistence of honey, mixed with charcoal powder, and distilled in a strong heat. By these means phosphorus will be obtained. The impurities with which phosphate may be contaminated, will partly remain undissolved, and partly be dissolved in muriatic acid. They may be detected and ascertained by the rules laid down in the beginning of this chapter.

The fluate of lime may be mixed with sulphuric acid and distilled. The fluoric acid will come over in the form of gas, and its weight may be ascertained. What remains in the retort, which will consist chiefly of sulphate of lime, may be analysed by the rules already laid down.

The borate of lime may be dissolved in nitric or sulphuric acid: the solution may be evaporated to dryness, and the boracic acid separated from the residuum by alcohol, which will dissolve it without acting on any of the other ingredients. The remainder of the dry mass may be analysed by the rules laid down in this chapter.

The diamond is a precious stone which has been known from the remotest ages. Its figure varies considerably, but most commonly it is crystallised in the form of a six-sided pyramid. It is the hardest of all bodies; the best tempered steel makes no impression on it; diamond powder can only be obtained by grinding one diamond against another. Its specific gravity is about 3·5. It is a non-conductor of electricity.

As the diamond is not affected by a considerable heat, it was for many ages considered as incombustible. Sir Isaac Newton observing that combustibles refract light more powerfully than other bodies, and that the diamond possesses this property in great perfection, suspected it, from that circumstance, to be capable of combustion. This singular conjecture was verified in 1694 by the Florentine academicians, in presence of Cosmo III., grand duke of Tuscany. By means of a burning-glass, they consumed several diamonds.

No attempt, however, was made to ascertain the product till 1772. Lavoisier, in a memoir published that year, showed that when the diamond is burnt carbonic acid is obtained, and that there is a striking analogy between it and charcoal. In 1785 Guyton Morveau found that the diamond is combustible when dropped into melted nitre; that it burns without leaving any residuum, and in a manner analogous to charcoal. This experiment was repeated with more precision by Mr. Tennant in 1797. The conclusion he drew from it was, that, when a diamond is burnt, the whole of the product is carbonic acid gas; that a given weight of diamond yields just as much carbonic acid gas as the same weight of charcoal; and that diamond and charcoal are both composed of the very same substance.

This conclusion, that diamond is nothing else but charcoal, was directly contrary to what one would have expected from comparing the two substances together. Their color, hardness, specific gravity, and electrical properties are exceedingly different; nor do they resemble each other in their combustibility. Charcoal takes fire at 370°, gives out a great deal of heat, and, when once kindled in oxygen gas, continues to burn till it be wholly consumed. The diamond, before it can be burnt, must be exposed to the sun's rays in the focus of a large burning-glass, or to a heat not under 5000°: even then it consumes but slowly, and ceases to burn the instant the action of the burning-glass is withdrawn. Its surface assumes a black color like charcoal; this crust is soon wasted, and another is formed in its place. In this manner a diamond, weighing 3·089 gr. Troy, gradually wasted away completely, when exposed by Morveau for one hour and forty minutes in the focus of the celebrated burning-glass of Tschirnhausen, while a thermometer exposed to the sun stood at 104°.

Coal is composed of charcoal, bitumen, and some portion of earth. The earths may be detected by burning completely a portion of the coal to be analysed. The ashes which remain after incineration consist of the earthy part. Their nature may be ascertained by the rules laid down in the preceding chapter. For the method of ascertaining the proportion of charcoal and bitumen in coal, we are indebted to Dr. Kirwan.

When nitre is heated red hot, and charcoal is thrown on it, a violent detonation takes place; and, if the quantity of charcoal be sufficient, the nitre is completely decomposed. Now it requires a certain quantity of pure charcoal to decompose a given weight of nitre. From the experiments of Lavoisier it follows, that, when the detonation is performed in close vessels under water, 13·21 parts of charcoal are capable of decomposing 100 parts of nitre. But, when the detonation is performed in an open crucible, a smaller proportion of charcoal is necessary, because part of the nitre is decomposed by the action of the surrounding air. Scheele found that, under these circumstances, ten parts of plumbago were sufficient to decompose ninety-six parts of nitre; and Dr. Kirwan found that nearly the same quantity of charcoal was sufficient for producing the same effect.

Macquer long ago observed that no volatile oily matter will detonate with nitre, unless it be previously reduced to a charcoal; and that then its effect upon charcoal is precisely proportional to the charcoal which it contains. Dr Kirwan, upon trying the experiment with vegetable pitch and maltha, found that these substances did not detonate with nitre, but merely burn upon its surface with a white or yellow flame; and that, after they were consumed, nearly the same quantity of charcoal was necessary to decompose the nitre which would have been required if no bitumen had been used at all. Now coals are chiefly composed of charcoal and bitumen. It occurred therefore to Dr. Kirwan that the quantity of charcoal which any coal contains may be ascertained by detonating it with nitre: for, since the bitumen of the coal has no effect in decomposing nitre, it is evident that the detonation and decomposition must be owing to the charcoal of the coal; and that, therefore, the quantity of coal necessary to decompose a given portion of nitre, will indicate the quantity of

carbon which it contains: and the proportion of charcoal and earth which any coal contains, being ascertained, its bituminous part may be easily had from calculation.

The crucible which he used in his experiments was large; it was placed in a wind furnace, at a distance from the flue, and the heat in every experiment was as equal as possible. The moment the nitre was red hot, the coal, previously reduced to small pieces of the size of a pin's head, was projected in portions of one or two grains at a time, till the nitre would no longer detonate; and every experiment was repeated several times to ensure accuracy. He found that 480 grains of nitre required fifty grains of Kilkenny coal to decompose it by this method. Therefore ten grains would have decomposed ninety-six of nitre; precisely the quantity of charcoal which would have produced the same effect. Therefore Kilkenny coal is composed almost entirely of charcoal.

Cannel coal, when incinerated, left a residuum of 3·12 in the 100 parts of earthy ashes: 66·5 grains of it were required to decompose 480 grains of nitre; but fifty parts of charcoal would have been sufficient: therefore 66·5 grains of cannel coal contained fifty grains of charcoal and 2·08 of earth; the remaining 14·42 grains must be bitumen. In this manner may the composition of any other coal be ascertained.

As for *sulphur*, to ascertain any accidental impurities with which it may be contaminated, it ought to be boiled in thirty times its weight of water, afterwards in diluted muriatic acid, and lastly treated with nitro-muriatic acid. These substances will deprive it of all its impurities, without acting on the sulphur itself, if the proper cautions be attended to. The sulphur may then be dried and weighed. The deficiency in weight will mark the quantity of the substances which contaminate the sulphur. The solutions may be evaporated and examined according to the rules laid down in the second and fourth chapters.

The diversity of *metallic ores* is so great that no general method of analysis can be given.

Gold ores. The presence of gold may easily be detected, by treating the mineral supposed to contain it with nitro-muriatic acid, and dropping muriate of tin into the solution. If the solution contains any gold, a purple precipitate immediately appears.

Native gold ought to be dissolved in nitro-muriatic acid; the silver, if any be present, falls to the bottom in the state of muriate, and may be separated by filtration and weighed. Pour sulphate of iron into the solution, and the gold is precipitated in the metallic state. The copper, if any be present, may be precipitated by a plate of iron. The presence of iron may be ascertained by dropping tincture of nut-galls into a portion of the solution.

The auriferous pyrites may be treated with diluted nitrous acid, which dissolves the iron, and separates the sulphur. The gold remains insoluble in the state of small grains.

Ores of platinum.—The most complete treatise on the analysis of this metal is that of Proust. But even his experiments are not sufficient to make us thoroughly acquainted with this complicated ore. Proust first separates the sand with which the grains of platina are mixed by exposing them to the blast of air. By heat he evaporates the mercury which still adheres to them, and then picks out the grains of gold, thus rendered visible. The ore is then dissolved in an acid composed of one part nitre and three parts muriatic acid. A black powder remains. This powder, when roasted, gives out phosphorus and sulphur. After this it is dissolved by nitro-muriatic acid, except a small residuum, which is plumbago. The solutions are then mixed. They consist of muriates of platinum and oxy-muriates of copper and iron. By evaporating till the liquid, when cold, assumes a consistency greater than honey, and inclining the retort, the oxy-muriates run off, and leave the muriate of platinum, which may be obtained pure by repeated solutions and crystallisations. The solution containing the muriates, and perhaps also a little platinum, is to be diluted with a great proportion of water, and pure ammonia dropt in. The red oxide of iron precipitates, and may be estimated by weighing it. When the solution is somewhat concentrated, ammonia precipitates the platinum in the state of a triple salt; and the copper, which now only remains, may be precipitated by a plate of iron.

Ores of silver.—The analysis of the ores of silver has been always considered as very important, on account of the great value of the metal.

1. Native silver is to be dissolved in nitric acid. The gold, if the ore contains any, remains in the state of a black powder, and may be dried and weighed. The silver may be precipitated by common salt: 100 parts of the precipitate, dried, denote about seventy-five parts of silver. The presence of copper may be ascertained by the green color of the solution, and by the blue color it assumes on adding ammonia. The copper may be precipitated by a plate of iron, or by the rules laid down hereafter. When the ore contains arsenic, its proportion may be estimated by weighing before and after fusion; for the arsenic is dissipated by heat; or the ore may be dissolved in nitric acid, which acidifies the arsenic. After the separation of the silver, the arsenic acid may be precipitated by nitrate of lead; 100 parts of the dry precipitate indicating about twenty-two of the arsenic.

2. Alloy of silver and antimony is to be treated with nitric acid, which dissolves the silver, and oxidates the antimony. The silver is estimated as above. The oxide of antimony may be reduced by fusion with four times its weight of black flux and a little soap.

3. Sulphuret of silver is to be treated with diluted nitric acid, which dissolves the silver, leaving the greater part of the sulphur untouched. The residuum is to be dried, and then the sulphur burnt off. The loss of weight gives the sulphur. The residuum is the gauge of the ore, which may be analysed by the rules laid down in the last chapter. The silver is to be precipitated by common salt; and the other metals, if any be present, may be ascertained as above. Part of the sulphur is always acidified. The acid thus formed may be precipitated by nitrate of

barytes; 100 parts of the dried precipitate indicating about 14·5 of sulphur.

4. Antimoniated silver ore was analysed by Klaproth thus: 100 parts were boiled in diluted nitric acid. The residuum, washed and dried, was twenty-six. These twenty-six were digested in nitro-muriatic acid. The residuum now weighed thirteen (so that thirteen had been dissolved), twelve of which were sulphur, and burnt away, leaving one part of silica. The nitro-muriatic solution, when diluted largely with water, let fall a precipitate, which weighed thirteen (or ten of pure antimony), and had the properties of oxide of antimony; for they did not evaporate till heated to redness; but, at that temperature, were dissipated in a gray smoke. The nitric solution was green. Common salt occasioned a precipitate, which weighed 87·75, equivalent to 65·81 of pure silver. After the separation of this muriate of silver, sulphate of soda occasioned no precipitate. Therefore the solution contained no lead. When supersaturated with soda, a gray precipitate fell, weighing five parts. On burning coals this precipitate gave out an arsenical smell. It was redissolved in nitric acid; sulphureted alkali occasioned a smutty brown precipitate; and the prussic alkali a prussian blue, which, after torrefaction, was magnetic. Hence he concluded that these five parts were a combination of iron and arsenic acid. The nitric solution, which had been supersaturated with ammonia, was blue; he therefore suspected that it contained copper. To discover this, he saturated it with sulphuric acid, and put into it a polished plate of iron. The quantity of copper was so small that none could be collected on the iron.

5. Sulphuret of silver and copper may be analysed as No. 3, separating the copper by a plate of iron.

6. Calciform silver ore may be analysed as No. 2, separating the copper by an iron plate, and estimating the carbonic acid that escapes when the ore is heated or dissolved in nitric acid.

7. Red silver ore was analysed by Vauquelin thus: 100 parts were digested in 500 parts of nitric acid previously diluted with water. The undissolved residuum, being washed and dried, weighed 42·06. Being treated with muriatic acid, it was all dissolved except 14·66 parts, which were sulphur. The muriatic solution, when diluted with a great quantity of water, deposited a white powder, which weighed 21·25, and was oxide of antimony. The nitric acid solution remained to be examined. Muriatic acid occasioned a heavy precipitate, which weighed 72·66 parts, and which was muriate of silver. Re-agents showed that the acid retained no other substance in solution.

8. Muriate of silver was analysed by Klaproth as follows: 100 parts were mixed with thrice their weight of pure carbonate of potassa, and melted together in a glass retort. The mass was dissolved in water, and the solution filtered. A residuum remained, which was dissolved in nitric acid, with the exception of a red powder; which, treated with nitro-muriatic acid, was dissolved, except a little muriate of silver, which, when reduced, yielded 0·5 of pure silver. Ammonia precipitated from the nitro-muriatic solution 2·5 parts oxide of iron. The nitric solution was precipitated by common salt; the muriate of silver thus obtained, yielded, when reduced, 67·25 of pure silver. The original aqueous solution of the alkaline mass was saturated with acetous acid, on which it deposited 1·75 parts of alumina. The solution was evaporated to dryness, and the dry mass treated with alcohol, which dissolved the acetite of potassa. The residuum, amounting to 58·75 parts, was dissolved in water; and, being treated with muriate of barytes, fifteen parts of sulphate of barytes precipitated, indicating the presence of about 0·5 of sulphuric acid, 0·75 sulphate of potassa. The remaining fifty-eight parts were muriate of potassa, indicating about twenty-one parts of muriatic acid.

Ores of mercury.—We have very few exact analyses of the ores of mercury, owing, perhaps, to the facility with which the mercury is extracted from them by distillation.

1. Native mercury and amalgam may be dissolved in nitric acid. The gold, if any be present, remains in the state of powder, and may be estimated by its weight. The affusion of water precipitates bismuth. Common salt precipitates the silver and part of the mercury; but the latter may be redissolved by a sufficient quantity of water, or, which is far better, of oxy-muriatic acid, while the muriate of silver remains insoluble. Lastly, the mercury may be precipitated by sulphate of iron, and estimated.

2. Native cinnabar may be treated with a mixture of three parts muriatic and one nitric acid, which dissolves the mercury, and leaves the sulphur. The mercury may then be estimated, as the last.

3. Hepatic mercurial ore has not been analysed. It may be attempted as in No. 2; or by dissolving it in nitric acid.

4. Muriate of mercury may be digested in muriatic acid till the whole is dissolved. Muriate of barytes precipitates the sulphuric acid, 100 parts of which are equivalent to 186 of sulphate of mercury; and, the proportion of this salt being known, we have that of muriate.

Ores of copper.—1. Native copper sometimes contains gold, silver, or iron. It may be dissolved in nitric acid; the gold remains in the state of a blackish, or rather violet-colored powder; the silver may be separated by a polished plate of copper (or precipitated from a portion of the solution by common salt); the iron may be separated by boiling the solution to dryness, and treating the residuum with water. By this process, the nitrate of iron is decomposed; the oxide of iron remains, while the water dissolves the nitrate of copper. This salt may be decomposed by boiling it with potassa: the precipitate, dried in a red heat, is black oxide of copper: 100 parts of it denote eighty of metallic copper.

2. Sulphuret of copper may be dissolved in diluted nitric acid. Part of the sulphur remains unaltered, and may be estimated by weighing it, and burning it off. Part is acidified, and may be precipitated by nitrate of barytes; 100 parts of the dried precipitate indicating 14·5 of sulphur. By evaporation to dryness, and solution of water, the iron is separated; and the copper

may be estimated as in No. 1; or muriatic acid may be used instead of nitric; but in that case it is more difficult to obtain a complete solution.

3. Gray copper ore was analysed by Klaproth thus: 300 parts of it were digested with four times their weight of nitric acid. This operation was repeated, and the two acid liquids mixed. The undissolved residuum was 188 parts. The nitric solution was green, and when common salt was added muriate of silver precipitated. The solution being now supersaturated with ammonia, 9·5 parts of a flaky red precipitate were obtained; which was found to be composed of silica, alumina, and iron by dissolving it in muriatic acid, and proceeding according to the rules laid down in the second chapter. A polished iron plate precipitated from the nitric solution sixty-nine parts of copper. The 188 parts residuum were boiled with six times their weight of muriatic acid; 105·5 parts remained, which were sulphur and silica. The muriatic acid solution being concentrated, yielded a little muriate of silver. Being diluted with a large portion of water, a white powder precipitated, which weighed 97·5 parts, and was oxide of antimony.

4. Red copper ore has only to be dissolved in muriatic acid, and the copper precipitated by a plate of iron: eighty-eight parts of the precipitated copper being equivalent to 100 of the orange oxide, of which the ore is composed.

5. The analysis of the oxides and carbonates of copper scarcely requires any remarks. The water and carbonic acid must be estimated by distillation in close vessels, and collecting the products. The ore may then be dissolved in nitric acid, and its copper ascertained as above.

6. Arseniate of Copper was thus analysed by Mr. Chenevix: the ore was dissolved in diluted nitric acid, and nitrate of lead poured in. The solution was evaporated till a precipitate began to appear, and then mixed with alcohol. Arseniate of lead precipitated: 100 parts of this salt indicate thirty-three of arsenic acid. The copper was separated from the nitric acid by boiling it with potass.

VI. *Ores of iron.*—Notwithstanding the great variety of iron ores, they may all, as far as analysis is concerned, be arranged under three heads: viz. 1. Sulphurets; 2. Oxides; and 3. Salts.

1. Pyrites, or sulphureted iron, may be treated repeatedly with boiling nitric acid, till the sulphur is acidified. Muriatic acid is then to be added, and the digestion continued till the whole be dissolved. Muriate of barytes is then to be added, to precipitate the sulphuric acid; 100 of the dried precipitate indicates 14·5 of sulphur. If the solution contains only iron, it may be precipitated by carbonate of soda, calcined to redness and weighed. But, if earths or manganese be present, we must proceed by the rules laid down in the second chapter.

2. If the oxides of iron be pure, i. e. contain nothing but iron, we have only to dissolve them in muriatic acid, and precipitate them as above. But it is very seldom that ores possess this degree of purity. The iron is usually combined with manganese, alumina, silica, or all these together. The analyses are to be conducted exactly by the rules in the second chapter.

3. The sparry iron ore may be analysed in the same manner, excepting only that the carbonic acid must be separated by distillation or solution in close vessels, and estimated.

4. Arseniate of iron was analysed by Mr. Chenevix thus: 100 parts of it were boiled with potass till the arsenic acid was separated. Nitrate of lead was mixed with the solution; 100 parts of the solution indicated thirty-three of arsenic acid. That portion of the ore which eluded the action of the potass was treated with muriatic acid; the undissolved residuum was silica. The muriatic acid was supersaturated with ammonia. The iron precipitated, but the copper was dissolved by the ammonia.

VII. *Ores of tin.*—For the method of analysing the ores of tin we are solely indebted to Klaproth.

1. The sulphuret of tin was thus analysed by Klaproth: 120 parts of the ore were digested with nitro-muriatic acid: forty-three parts remained undissolved. Of these, thirty burnt away with a blue flame, and were sulphur; of the remaining thirteen, eight dissolved in nitro-muriatic acid: the undissolved five were heated with wax, and yielded a grain of iron attracted by the magnet. The rest was a mixture of alumina and silica. The nitro-muriatic solution was completely precipitated by potass, and the precipitate redissolved in muriatic acid. A cylinder of tin precipitated forty-four parts of copper from this solution, and lost itself eighty-nine parts of its weight. A cylinder of zinc precipitated 130 parts of tin; so that, deducting the eighty-nine parts of tin dissolved during the precipitation of the copper, forty-one remained for the tin contained in the ore.

2. Tinstone was thus analysed by Klaproth: 100 parts of the ore were heated to redness, with 600 parts of potass in a silver crucible; and, the mixture being treated with warm water, eleven parts remained undissolved. These eleven, by a repetition of the treatment with potass, were reduced to two and a quarter. This small residuum dissolved in muriatic acid. Zinc precipitated from the solution one half part of tin, and the prussian alkali gave a blue precipitate, which indicated one-fourth part of iron. The alkaline solution was saturated with muriatic acid; a white precipitate appeared, but was redissolved by adding more acid. The whole was precipitated by carbonate of soda. The solution, which had a yellowish color, was re-dissolved in muriatic acid; and, a cylinder of zinc being inserted into the solution, seventy-seven of tin were obtained, indicating nearly ninety-eight parts oxide of tin.

VIII. *Ores of lead.*—1. Sulphuret of lead usually contains a little silver, and sometimes also antimony and zinc. It may be treated with diluted nitric acid, which leaves only the sulphur undissolved, the weight of which is to be taken, and its purity determined by combustion. If antimony be present, it will either remain in the state of a white oxide, or, if dissolved, will be precipitated by diluting the solution with water. Muriatic acid is to be added, and the solution evaporated till it is reduced to a small portion. Muriate of lead and of silver precipitate. The

first of these may be dissolved in boiling water; the second remains insoluble. Westrum separated the muriate of silver, by digesting the precipitate with ammonia. The liquid from which the muriates are separated may contain iron, zinc, copper. The iron may be precipitated by ammonia added in excess: the copper by a plate of zinc: the zinc by carbonate of soda, reduced to the metallic state and weighed, subtracting what had been separated from the plate of zinc.

2. Plumbiferous antimoniated silver ore was thus analysed by Klaproth: it was digested with seven times its weight of nitric acid, by which part was dissolved. The residuum was treated repeatedly with muriatic acid, which was poured off while boiling hot. What remained undissolved was sulphur mixed with a little silica. Common salt was added to the nitric solution: two precipitates appeared; 1. A heavy fleaky one, which was muriate of silver; 2. Acicular crystals of muriate of lead. These crystals were dissolved in water, and the solution added to the nitric solution. From this solution, sulphate of soda precipitated a heavy white powder, which was sulphate of lead. Lastly, ammonia afforded a precipitate, which was a mixture of iron and alumina. The muriatic solution being concentrated, crystals of muriate of lead appeared; the concentration was continued as long as any crystals formed. The residuum, being diluted with water, gave a white precipitate, which was oxide of antimony.

3. The bismuthic silver ore was analysed by Klaproth in nearly the same manner.

4. Carbonate of lead may be dissolved in nitric acid, collecting and estimating the carbonic acid. By boiling the solution, the iron and antimony (if present) will be separated, and may be estimated by solution in muriatic acid; precipitating the antimony by water, and the iron by ammonia. From the nitric solution the lead may be precipitated by sulphuric acid, and the earth may be examined by the rules laid down in the second chapter.

5. Phosphate of lead may be dissolved in boiling muriatic acid. The solution is to be diluted with water till the crystals of muriate of lead are dissolved; being then saturated with ammonia, the lead and iron are precipitated. Dissolve the precipitate in muriatic acid, evaporate to dryness, and treat the dry mass with alcohol. The muriate of iron is dissolved; but the muriate of lead remains. Finally, drop lime water into the ammoniacal solution, as long as any precipitate appears. That precipitate indicates the proportion of phosphoric acid.

6. Arseniate of lead has not been analysed. It might be treated with an alkali which would separate the lead. This metallic precipitate is then to be redissolved in nitric acid, and analysed by the methods above described. The alkaline arseniate may be dissolved in water, and treated with nitrate of lead; 100 parts of the dry precipitate indicate thirty-three of lead.

7. Molybdate of lead was thus analysed by M. Hatchet: the ore was boiled repeatedly with sulphuric acid, till the acid refused to dissolve any more. The solution contained the molybdic acid. The undissolved powder (sulphate of lead) was boiled for an hour with carbonate of soda, and then washed. Nitric acid now dissolved it, except a little silica. The lead was precipitated from this solution by sulphuric acid; after which ammonia separated a little oxide of iron. The sulphuric acid solution was diluted with sixteen parts of water, and saturated with ammonia; a little oxide of iron gradually precipitated. The solution was now evaporated to dryness, and the mass strongly heated, to separate the sulphate of ammonia. The residuum, repeatedly treated with nitric acid, was converted into yellow molybdic acid.

IX. *Ores of nickel.*—No exact method of analysing the ores of nickel has yet been published.

1. Kupfer nickel may be dissolved in nitric acid, by which the greater part of the sulphur will be separated. The arsenic may be afterwards precipitated by the affusion of water. A plate of iron will expel the copper. Precipitate by potass added in excess, and boil the precipitate, which will separate the arsenic and sulphur completely. Dissolve the precipitate (previously exposed moist for some time to the air) in acetous acid, and add an excess of ammonia. The iron is precipitated; but the cobalt and nickel remain in solution. Evaporate, and the cobalt is deposited; then, by continuing the evaporation to dryness, the nickel is obtained.

2. The arseniate of nickel may be boiled with potass, which separates the acid; the residuum may be analysed as No. 1.

X. *Ores of zinc.*—1. Blende may be treated with diluted nitric acid, which will separate the sulphur, the siliceous gangue, &c. The purity of the sulphur is to be ascertained by combustion, and the residuum analysed in the manner formerly described. Precipitate the nitric solution by soda: redissolve in muriatic acid; precipitate the copper by a plate of iron: separate the iron by an excess of ammonia. The zinc now only remains in the solution, and may be obtained by evaporating to dryness, re-dissolving in muriatic acid, and precipitating by soda.

2. Calamine may be digested in nitric acid and the insoluble residuum boiled with muriatic acid repeatedly; what remains, after dilution with boiling water, is silica. The nitric solution contains zinc, and probably also iron and alumina; evaporate to dryness, re-dissolve, and add an excess of ammonia. The iron and alumina either remain undissolved, or are precipitated, and may be separated by potass. The zinc may be precipitated by an acid, or by evaporation to dryness. The muriatic solution probably contains iron and alumina, which may be precipitated by the rules already laid down.

XI. *Ores of antimony.*—1. Native antimony may be treated with nitric acid, which will oxidate the antimony, and partly dissolve the arsenic. This last metal may be precipitated by concentration and the affusion of water. What remains with the antimony may be dissolved by digestion in boiling water.

2. Sulphuret of antimony is to be treated with nitro-muriatic acid. The sulphur and the muriate of silver, if any be present, will remain. Water precipitates the antimony, sulphuric acid the lead, and ammonia the iron.

XII. *Ores of bismuth.*—Native bismuth may be treated with nitric acid. Repeated concentrations and affusions of water precipitate the bismuth, and perhaps the arsenic; but this last may be redissolved in boiling water. The cobalt remains, and may be examined by the rules laid down in § XV. The same analysis succeeds with the other ores of cobalt. The sulphur, when present, remains undissolved.

XIII. *Ores of tellurium.*—Klaproth dissolved the white gold ore of Fatzbay in nitro-muriatic acid, and added potass in excess to the solution. A brown precipitate remained undissolved, which was a mixture of gold and iron. It was redissolved in nitro-muriatic acid; the gold first precipitated by nitrate of mercury, and then the iron by potass. The potass in the first solution being saturated with muriatic acid the oxide of tellurium precipitated. The other ores may be analysed in the same manner, only the precipipitate occasioned by the potass must be treated according to the metals of which it consists.

XIV. *Ores of arsenic.*—1. Native arsenic may be treated with nitro-muriatic acid. The silver and gold remain; the first in the state of a muriate, the second may be dissolved by nitro-muriatic acid, and precipitated by sulphate of iron. The arsenic may be precipitated by concentrating the nitric solution, and then diluting with water. The iron may then be precipitated by ammonia.

2. The sulphureted ores of arsenic may also be treated with diluted nitro-muriatic acid. The sulphur remains undissolved; the arsenic may be precipitated by concentration and the affusion of water; the iron by ammonia.

3. Oxide of arsenic may be dissolved in sixteen parts of water. The solution displays acid properties, and nitrates of silver and of mercury occasion precipitates in it.

XV. *Ores of cobalt.*—1. White cobalt ore was thus analysed by Tassaert:—To ascertain the proportion of arsenic he treated the ore with diluted nitric acid, and obtained a complete solution. Crystals of white oxide of arsenic were deposited, and by repeated evaporations he separated the whole of the arsenic, and ascertained its weight. He then boiled a new portion of the ore with four times its weight of nitric acid, and thus acidified the arsenic and obtained a solution. This solution was treated with potassa, which retained the arsenic acid, and separated the other bodies. A precipitate of arsenic of cobalt, which had fallen when the nitric solution was diluted with water, was treated with potassa. The residuum, with the precipitate occasioned by the potassa, was dissolved in nitric acid, and ammonia added in excess. Part was retained in solution by the ammonia, but part was precipitated. The precipitate was dissolved in acetous acid, and the solution repeatedly evaporated to dryness. By this process the oxide of iron gradually separated in the form of a red powder. The dissolved part was acetite of cobalt. It was decomposed by the addition of ammonia in excess, which redissolved the cobalt. By these processes the arsenic and iron were separated; the cobalt was retained by the ammonia, and was obtained by evaporation. To ascertain the proportion of sulphur in the ore, a new portion was boiled with nitric acid. On cooling, crystals of white oxide of arsenic were deposited. These being separated, nitrate of barytes was added to the solution; 100 parts of the dried precipitate indicated 14·5 of sulphur. The other ores of cobalt may be analysed nearly in the same way. See § XII.

XVI. *Ores of manganese.*—1. Barytated manganese was treated by Vauquelin with muriatic acid; oximuriatic gas passed over, and the whole was dissolved except a little charcoal and silica. The solution, when evaporated, yielded crystals of muriate of barytes. These were separated, and the liquid, evaporated to dryness, yielded a yellow mass soluble in alcohol, and tinging its flame with yellow brilliant sparks. The proportion of barytes was ascertained by precipitating it in the state of a sulphate; the manganese by precipitating it by carbonate of potassa.

2 The gray ore of manganese was treated by the same chemist with muriatic acid; some silica remained undissolved. Carbonate of potassa was added to the solution. The precipitate was at first white, but became black when exposed to the air. It was treated with nitric acid, which dissolved every thing. The nitric solution, when mixed with carbonate of potassa, deposited only carbonate of lime. The black residuum was mixed with sugar, and treated with nitric acid. The solution was complete; therefore no iron was present.

XVII. *Ores of tungsten.*—1. Wolfram was analysed by the Elhuyarts, and by Vauquelin and Hecht, nearly as follows:—The ore was boiled with muriatic acid, and then digested with ammonia alternately till the whole was dissolved. The ammoniacal solution, being evaporated to dryness and calcined, left the yellow oxide of tungsten in a state of purity. The muriatic solutions were mixed with sulphuric acid, evaporated to dryness, and the residuum redissolved in water. A little silica remained. Carbonate of potassa precipitated a brown powder from this solution. This powder was treated with boiling nitric acid repeatedly till the iron which it contained was oxidated to a maximum. It was then digested in acetous acid, which dissolved the manganese, and left the iron. Finally the manganese was precipitated by an alkali.

2. Tungsten of lime may be treated with nitro-muriatic acid till every thing soluble is taken up. The residuum is yellow oxide of tungsten. Its purity may be tried by solution in ammonia. The nitro-muriatic solution contains lime, and perhaps a little iron and alumina. It may be examined by the rules laid down in the second chapter.

XVIII. *Ores of molybdenum.*—Molybdena may be treated with nitric acid, and successively boiled upon it till it is converted into a white powder. This powder, washed and dried, is molybdic acid. The liquid obtained by washing the acid, on the addition of potassa, deposits some more molybdic acid. This being separated, muriate of barytes is to be dropt into it as long as any precipitate appears: 100 parts of this precipitate indicate 14·5 of sulphur.

XIX. *Ores of uranium.*—1. Pechblende, or the black ore of uranium, was dissolved by Klaproth

in nitric acid. The undissolved part is a mixture of silica and sulphur. By evaporating the solution nitrate of lead was precipitated; then nitrated uranium in crystals. The solution being now evaporated to dryness, and treated again with nitric acid, left the iron in the state of red oxide.

2. Uranitic ochre may be treated with nitric acid, which dissolves the uranium, and leaves the iron. The purity of the iron may be tried by the rules already laid down.

3. Green mica was dissolved by Klaproth in nitric acid, and ammonia added in excess to the solution. The oxide of uranium was precipitated; that of copper retained.

XX. *Ores of titanium.*—1. The ores of titanium, reduced as usual to a fine powder, are to be fused with potassa or its carbonate. The melted mass is then to be dissolved in hot water. A white precipitate gradually appears, which is the white oxide of titanium. This is all that is necessary to analyse the first species.

2. But when iron and silica are present the following method of Chenevix may be adopted:—Saturate the alkaline solution with muriatic acid; white oxide of titanium precipitates. Separate the precipitate, and evaporate the solution to dryness. Redissolve the residuum in water. The silica remains behind. Precipitate the solution by an alkali; add the precipitate to the whole oxide obtained, and dissolve the whole in sulphuric acid. From this solution phosphoric acid precipitates the titanium, but leaves the iron.

3. The third species, which contains lime and no iron, is to be fused with potassa, dissolved in muriatic acid, and the silica separated in the usual way. After this the titanium is first to be separated from the muriatic solution by ammonia; and afterwards the lime by an alkaline carbonate.

XXI. *Ores of chromum.*—1. Vauquelin analysed the chromate of lead thus:—When boiled with a sufficient quantity of carbonate of potassa, a lively effervescence takes place; the acid combines with the potassa, and the carbonate of lead is formed, and remains undissolved. It may be dissolved in nitric acid, and its quantity ascertained by precipitation with sulphuric acid. Or the chromate may be treated with muriatic acid; muriate of lead precipitates, and chromic acid remains in solution. This process must be repeated till the whole of the ore is decomposed. There remains in solution chromic acid, mixed with a little muriatic, which may be separated by oxide of silver.

2. Tassaert analysed the chromate of iron as follows:—It was melted with eight times its weight of potassa in a crucible. The resulting mass dissolved in water except a brown powder. This residuum was treated with muriatic acid, which dissolved a part of it. The residuum was treated as at first with potassa and muriatic acid, till the whole was dissolved. The alkaline solution contained the chromic acid; the muriatic solution the iron, still mixed with a little chromum. It was precipitated by potassa, and the precipitate boiled with that alkali, to separate the whole of the chromic acid What remained was pure oxide of iron. The chromic solutions were saturated with nitric acid, and mixed with nitrate of lead. The resulting precipitate indicated the proportion of chromic acid; for 100 parts of chromate of lead indicate about thirty-five of chromic acid.

The method of analysing the different ores with precision being ascertained, we have it in our power to obtain the metals in a state of purity.

1. *Gold.* To obtain pure gold we have only to dissolve the gold of commerce in nitro-muriatic acid, and precipitate the metal by dropping a very diluted solution of sulphate of iron; the powder which precipitates, after being well washed and dried, is pure gold.

2. *Platinum* can scarcely be obtained perfectly pure in the metallic state, at least in any considerable quantity; because a sufficient heat for melting it cannot be obtained. But its oxide may be procured quite pure from the muriate of platinum and ammonia. This salt is to be decomposed by a violent heat, and the residuum, if necessary, may be redissolved in nitro-muriatic acid, and precipitated with soda.

3. *Silver.*—Dissolve the silver of commerce in nitric acid, and precipitate with a diluted solution of sulphate of iron. The precipitate is pure silver. Or precipitate with common salt; form the precipitate into a paste with soda; put it into a crucible lined with soda, and fuse it with a brisk heat. This process gives a button of pure silver.

4. *Mercury* may be obtained pure by distilling a mixture of two parts cinnabar, and one part iron filings, in an iron retort. The mercury comes over, and the sulphuret of iron remains; or the oxy-muriate of mercury may be decomposed by ammonia, and the precipitate heated either by itself or mixed with oil.

5. *Copper* may be dissolved in muriatic acid, and the copper precipitated by a polished plate of iron: or the black oxide of copper, obtained by decomposing cuprated ammonia, may be melted with its own weight of pounded glass and pitch.

6. *Iron* can scarcely be obtained perfectly free from carbonate. The processes described in a former part of this work furnish it as pure as it can be procured. See Iron.

7. *Tin* may be obtained pure by solution in strong nitric acid: the white oxide of tin is formed, which is insoluble. Let it be digested first with muriatic acid, and afterwards with aqua regia. Mix the oxide, thus purified, with its weight of pitch and a little borax, and melt it in a crucible.

8. *Lead* may be dissolved in nitric acid, and precipitated by sulphate of soda; wash the precipitate, and melt it in a crucible with two and a half times its weight of black flux.

9. *Nickel* may be obtained pure from kupfer nickel, by roasting the ore previously mixed with charcoal; dissolving it in nitric acid; evaporating the solution to dryness; redissolving it in water; precipitating by potass; and boiling the precipitate with potass. The precipitate is then to be edulcorated, dissolved in acetous acid, the solution evaporated to dryness, re-dissolved in water, and precipitated by ammonia in excess, which redissolves the oxides of cobalt and nick-

el. By evaporating this solution the cobalt is precipitated, and the solution becomes blue. This last solution, evaporated to dryness, gives pure oxide of nickel. Form this oxide into a paste with oil; mix it with two or three parts of black flux, and put it into a crucible, covering it up with borax and common salt. Heat the crucible violently for an hour and a half in a smith's forge. A button of pure nickel is obtained.

10. *Zinc* may be dissolved in sulphuric acid, and a plate of zinc allowed to remain for a considerable time in the solution. It is then to be filtered, and the zinc to be precipitated with soda. The precipitate, edulcorated and dried, is to be mixed with half its weight of pure charcoal, and distilled in an earthenware retort. The zinc is found pure in the neck of the retort.

11. *Antimony* may be dissolved in nitro-muriatic acid, and precipitated by the affusion of water. The precipitate is to be mixed with twice its weight of tartar, and fused in a crucible. A button of pure antimony is obtained.

12. *Bismuth* may be dissolved in nitric acid, and precipitated by water. The edulcorated precipitate, formed into a paste with oil, and rapidly fused with black flux, gives a button of pure bismuth.

13. *Tellurium* was obtained pure by Klaproth by forming its oxide into a paste with oil, and heating it to redness in a retort. The metal was rapidly revived.

14. *Arsenic*, in the state of white oxide, may be dissolved in muriatic acid, precipitated by the affusion of water, redissolved and a plate of zinc inserted into the solution, mixing with it at the same time a little alcohol. The arsenic is precipitated in the metallic state.

15. *Cobalt* ores ought to be roasted for some time, adding charcoal or oil to favor the evaporation of the arsenic. They are then to be dissolved in nitric acid, the solution evaporated to dryness, and redissolved in water. The solution is to be precipitated by potass, and the precipitate boiled with that of alkali. It is then to be edulcorated, dissolved in acetous acid, the solution evaporated to dryness, and redissolved in water. Precipitate by ammonia, and redissolve the precipitate in ammonia. Evaporate the ammoniacal solution to dryness. Mix the oxide thus obtained with oil and black flux; pour it into a crucible; cover it with borax; and expose it for an hour and a half to the heat of a forge. A pure button of cobalt is obtained.

16. *Manganese*.—Digest the black oxide of manganese repeatedly in nitric acid; then mix it with sugar; and dissolve it in sugar. Filter the solution; precipitate by an alkali; form the white oxide thus obtained into a paste with oil; and put it into a crucible well lined with charcoal. Expose the crucible for an hour to the strongest heat of a forge.

17. *Tungsten* was obtained by Elhuyart by heating the yellow oxide violently in a crucible lined with charcoal; but this process has not succeeded with other chemists.

18. *Molybdenum* may be obtained by forming molybdic acid into a paste with oil, and heating it violently in a crucible lined with charcoal.

19. *Uranium* is procured by forming the yellow oxide of that metal into a paste with oil, drying it in a moderate heat, putting it into a crucible lined with charcoal, with a little lamp-black strewed over it. After luting on the cover, it is to be heated, at first gently, and then violently, for three-quarters of an hour.

20. *Titanium*, in a very small proportion, was obtained in the metallic state by mixing together 100 parts of the red oxide of the metal, fifty parts of borax, and five parts of charcoal, and forming the mixture into a paste with oil. This paste was put into a crucible lined with charcoal, and exposed for an hour and a half to the violent heat of a forge.

21. *Chromum* was obtained by Vauquelin, in the metallic state, by putting a portion of chromic acid into a charcoal crucible, enclosed in a common crucible lined with charcoal, and exposing it for an hour to the violent heat of a forge.

For the phenomena of the phosphorescence of minerals, see our article LIGHT.

We have now to present to the reader an arrangement of the principal mineral substances with which this science is conversant; and cannot better accomplish the task than by transcribing the Tabular View of simple minerals, contained in professor Cleveland's Elementary Treatise. The divisions into species and the nomenclature of the species are, he observes, as strictly chemical as the present state of mineralogical knowledge will permit. In the class of earthy compounds, an accurate division into genera is impracticable. An attempt has therefore been made to arrange the species of this class, in some degree, according to their composition, as far as that can be ascertained from the results of chemical analysis. In other words, those minerals which most resemble each other in the results of their analysis, are collected into the same group. We are hereby enabled to determine how far those minerals which appear to be composed of the same ingredients, united in different proportions, resemble each other in their external characters. In forming these groups, the latest analyses of the most experienced chemists have been employed, and principally those made by Klaproth, Vauquelin, and Chenevix. It has also been an object to select analyses made on the purest crystallised specimens. In general, no ingredient has been considered essential which does not occur in at least five per cent. in specimens apparently pure; while, at the same time, some ingredients, which occur in greater proportions in specimens obviously impure, have been rejected as accidental. After all, it must be obvious that this arrangement of the earthy minerals is liable to various alterations, in proportion as chemical analysis becomes more correct.

In this Tabular View, subspecies, varieties, and subvarieties, are distinguished from each other by a different type, and by their position in the column: a number of species recently discovered, and concerning which little is yet known, are alphabetically arranged in an appendix to the earthy class: those species which have never been analysed are marked by an asterisk. The place of such minerals, when not contained in

the appendix, is determined merely by some external analogies. Subvarieties, though included in the Tabular View, are not numbered in the descriptions.

We have only to add that it is amongst the most pleasing portions of our duty to acknowledge important aid in this walk of science from the New World. Thus commenced the truly noble career of the United States. During the war that achieved her independence, she taught us electricity; and her well ascertained and well defended liberty will increasingly enable her, we do not doubt, not only to take the lead, as she does, in all the scientific pursuits of her own hemisphere, but to yield back to Europe 'a full reward' for all the early lessons of civilisation and science she received from us. Her most distinguished sons, at any rate, are always most ready to remember these, as, with feelings far removed from jealousy, we deem it imperative upon us thus to acknowledge this practical kind of return.

TABULAR VIEW.

The species printed in Italics have not hitherto been observed in crystals, nor even with a crystalline structure.—Substances enclosed by a parenthesis, in the column of subspecies, are appendices to the species or subspecies.

Class I.—SUBSTANCES NOT METALLIC, COMPOSED ENTIRELY, OR IN PART, OF AN ACID.

This class contains four orders. In the first order the acid is free or not combined; in the second it is combined with an alkali; in the third with an earth or earths; and in the fourth with both an alkali and an earth. Hence the presence of an acid, provided it be not united to a metallic base, characterises this class.

Order I.—Acids not combined.

The base of the acid determines the genus. All the species in this order have oxygen, as a common ingredient, so combined with a base as to produce an acid.

Genus I.

Species 1. Sulphuric acid.
2. *Sulphurous acid.*

Genus II.

1. *Muriatic acid.*

Genus III.

1. *Carbonic acid.*

Genus IV.

1. Boracic acid

Order II.—Alkaline salts.

These salts are composed of an alkali, united to an acid. Hence an alkali, so combined as to form a salt, characterises this order. Each alkali designates a genus.

Genus I.—*Ammonia.*

1. Sulphate of ammonia.
2. Muriate of ammonia.

Genus 2.—*Potassa.*

1. Nitrate of potassa.

Genus III.—*Soda.*

1. Sulphate of soda.
2. Muriate of soda.
3. Carbonate of soda.
4. Borate of soda.

Order III.—Earthy Salts.

These consist of an earth or of earths, united to an acid. Hence an earth, so combined as to form a salt, characterises this order. Each genus is determined by the earth it contains.

Genus I.—*Barytes.*

Species. Subspecies. Varieties and Subvarieties.

1. Sulphate of barytes.
lamellar.
curved.
crested.
columnar.
radiated.
fibrous.
concreted.
granular.
compact.
earthy.
fetid.
2. Carbonate of Barytes.

Genus II.—*Strontian.*

1. Sulphate of strontian.
foliated.
fibrous.
calcareous.
2. Carbonate of strontian.
3. Barystrontianite.

Genus III.—*Lime.*

1. Carbonate of lime.
Calcareous spar.
crystallised.
laminated.
granular.
fibrous.
Satin spar.
compact.
earthy.
Blue Vesuvian.
Chalk.
Agaric mineral.
Fossil farina
concreted.
Oolite.
Pisolite.
Calcareous sinter.
Stalactite.
Alabaster.
Calcareous tufa.
incrusting
Argentine.
Aphrite.
magnesian.
crystallised.
Miemite.
Dolomite.
columnar.
Magnesian limestone.
Gurhofite.
Brown spar.
siliceous.
Madreporite.
fetid.
bituminous.
ferruginous.
Calp.

Species. Subspecies. Varieties and Subvarieties.

Marl.
indurated.
Septaria.
earthy.
Bituminous marlite.
2. Arragonite.
fibrous.
coralloidal.
3. Phosphate of lime.
Apatite.
Asparagus stone.
fibrous.
massive.
pulverulent.
siliceous.
4. Fluate of lime.
Fluor spar.
massive.
compact.
earthy.
argillaceous.
fetid.
5. Sulphate of lime.
Selenite.
massive.
acicular.
Gypsum.
fibrous.
granular.
compact.
branchy.
snowy.
earthy.
Plaster stone.
6. Anhydrous sulphate of lime.
sparry.
granular.
fibrous.
compact.
convoluted.
silico-anhydrous.
7. Siliceous borate of lime.
Botryolite.
8. Arseniate of lime.
9. Nitrate of lime.

Genus IV.—*Magnesia.*

1. Sulphate of magnesia.
2. Carbonate of magnesia.
crystallised.
compact.
pulverulent.
3. Borate of magnesia.

Genus V.—*Alumine.*

1. Mellate of alumine.
2. Phosphate of alumine.
3. Subsulphate of alumine.

Order IV.—SALTS WITH AN ALKALINE AND EARTHY BASE.

1. Subsulphate of alumine and potassa.
siliceous.
2. Sulphate of alumine and potassa.
3. Fluate of soda and alumine.
4. Glauberite.
5. Polyhalite.

Class II.—EARTHY COMPOUNDS, OR STONES.

The minerals which belong to this class are composed chiefly of earths, combined with each other; they frequently contain some metallic oxide, and sometimes an alkali, or acid.

Species. Subspecies. Varieties and Subvarieties.

Silex nearly pure.

1. Quartz.
common.
limpid.
smoky.
yellow.
blue.
rose red.
irised.
aventurine.
milky.
greasy.
radiated.
tabular.
granular.
arenaceous.
pseudomorphous.
Amethyst.
Prase.
ferruginous.
yellow.
red.
greenish.
fetid.
Cat's eye.
Chalcedony.
common.
Cacholong.
Carnelian.
Sardonyx.
Plasma.
Siliceous sinter.
Hyalite.
Michaelite.
Heliotrope.
Chrysophrase.
Opal.
precious.
common.
Hydrophane.
Girasol.
Semi-opal.
Menilite.
ferruginous.
(Opalised wood).
Flint.
swimming.
Hornstone.
(Agatised wood).
Silicecalce.
Buhrstone.
Jasper.
common.
striped.
Egyptian.
(Porcellanite.)
Leelite.
(Agate.)

Alumine nearly pure.

2. Sapphire.
perfect.
blue.
violet.
red.
yellow.
green.
limpid.
chatoyant.
asteriated.
Corundum.
Emery.

	Species.	Subspecies.	Varieties and Subvarieties.
Alumine and water.	3. Diaspore.		
	4. *Turquoise.*		
Alumine and magnesia.	5. Spinelle.		
		Ruby.	
		Ceylanite.	
Alumine and silex.	6. Fibrolite.		
	7. Cyanite.		
			Rhætizite.
	8. Staurotide.		
	9. Pinite.		
	10. Bucholzite.		
	11. Nepheline.		
Alumine, silex, and alkali.	12. Andalusite.		
Alumine, magnesia, and silex.	13. Lazulite.		
		Blue spar.	
Alumine, silex, and lime.	14. Chrysoberyl.		
Alumine, silex, & fluoric acid.	15. Topaz.		
			Pyrophysalite.
		Pycnite.	
	16. Brucite.		
Alumine, silex, and zinc.	17. Gahnite.		
Yttria, silex, and cerium.	18. Gadolinite.		
Zirconia and silex.	19. Zircon.		
			common.
			Hyacinth.
Silex, alumine, and alkali.	20. *Siliceous slate.*		
			Basanite.
	21. *Clinkstone.*		
	22. *Pumice.*		
	23. *Obsidian.*		
			vitreous.
			Pearlstone.
	24. *Pitchstone.*		
	25. Spodumene.		
			Killinite.
	26. Petalite.		
	27. Lepidolite.		
	28. Mica.		
			laminated
			lamellar.
			prismatic.
	29. Leucite.		
	30. Fettstein		
			Gabronite.
			Lythrodes.
	31. Lapis lazuli.		
	32. Schorl.		
			common.
			Tourmaline.
			green.
			yellow.
			white.
			Indicolite.
		Rubellite.	
	33. Haüyne.		
Silex, alumine, lime, and alkali.	34. Gehlenite.		
	35. Feldspar.		
			common.
			green.
			Adularia.
			siliceous.
			Albite.
			glassy.
			Icespar.
			opalescent.
			aventurine.

	Species.	Subspecies.	Varieties and Subvarieties.
Silex, alumine, lime, and alkali.			Petuntze
			granular
			compact
		fetid.	
	36. *Jade.*		
		Nephrite.	
		Saussurite.	
		Axestone.	
Silex, alumine, and glucine.	37. Emerald.		
		precious.	
		Beryl.	
	38. Euclase.		
Silex, alumine, and magnesia.	39. Iolite.		
			Peliom.
			Steinheilite.
Silex, alumine, and lime.	40. *Basalt.*		
			columnar.
			tabular.
			globular.
			amorphous.
	41. *Wacke.*		
			Iron clay.
	42. Dipyre.		
	43. Scapolite.		
	44. Indianite.		
	45. Axinite.		
	46. Garnet.		
			precious.
			Pyrope.
			Topazolite.
			Succinite.
			common
			Melanite.
			Pyreneite.
			Grossular.
			Allochroite.
			Colophonite.
		manganesian.	
		(Romanzovit).	
	47. Aplome.		
	48. Epidote.		
			Zoisite.
			arenaceous.
		manganesian.	
	49. Cinnamon stone.		
	50. Idocrase.		
			Egeran.
	51. Meïonite.		
	52. Byssolite.		
	53. Prehnite.		
			crystallised.
			Koupholite.
			fibrous.
Silex, alumine, lime, and water.	54. Ædelite		
	55. Stilbite.		
	56. Zeolite.		
			Natrolite.
			mealy.
			Crocalite
	57. Laumonite.		
	58*Melilite.		
Silex, alumine, soda, and muriatic acid.	59. Sodalite.		
Silex, alumine, alkali, and water.	60. Analcime.		
			Sarcolite.
	61. *Bildstein.*		
	62. Nacrite.		
	63. Chabasie		

	Species.	Subspecies.	Varieties and	Subvarieties.
Silex, alumine, and water.	64. Karpholite.			
Silex, lime, and iron.	65. Yenite.			
Silex, lime, and water.	66. Schaalstein.			
Silex, lime, alkali, and water.	67. Apophyllite.			
			Albin.	
Silex, barytes, alumine, and water.	68. Harmotome.			
Silex and magnesia.	69. Chrysolite.			
			common,	
			Olivine.	
				meteoric.
	70. Hypersthene.			
Silex, magnesia, and lime.	71. Tremolite.			
			common.	
				glassy.
			fibrous.	
			Baikalite.	
	72. Asbestus.			
			Amianthus.	
			common.	
			Mountain cork.	
			ligniform.	
			compact.	
	73. Amianthoide.			
	74. Diopside			
Silex, alumine, lime, and magnesia.	75. Augite.			
			common.	
			Sahlite.	
			Fassaite.	
			Coccolite.	
	76. Hornblende.			
		common.		
			basaltic.	
			lamellar.	
			fibrous.	
			slaty.	
			Carinthin.	
		Actynolite.		
			common.	
				massive.
				glassy.
			acicular.	
				fibrous.
			Pargasite.	
	77. Anthophyllite.			
	78. Diallage.			
		green.		
		metalloidal.		
		Bronzite.		
	79. Pyrallolite.			
	80. *Macle.			
	81. *Native lime.*			
	82. Hydrate of magnesia.			
	83. *Magnesite.*			
			Meerschaum.	
			Argillomurite.	
Silex, magnesia and water.	84. *Serpentine.*			
			precious.	
			common.	
	85. Talc.			
			common.	
				fibrous.
			indurated.	
				scaly.
		Steatite.		
			common.	
			Potstone	

	Species.	Subspecies.	Varieties and	Subvarieties.
Silex, magnesia and alumine.	86. Chlorite.			
			common.	
				earthy.
			slaty.	
		(Green earth).		
		(Pimelite).		
	87. *Argillaceous slate.*			
			Argillite.	
				shining.
				Roof slate.
			Shale.	
				bituminous.
			Novaculite.	
			Aluminous slate.	
				shining.
			graphic.	
	88. *Tripoli.*			
			Rotten stone.	
			Polishing slate.	
	89. *Claystone.*			
	90. *Clay.*			
			Kollyrite.	
			Allophane.	
			Lenzinite.	
			Wallerite.	
			Kaolin.	
			Cimolite.	
			adhesive.	
			Potter's.	
				Pipe clay.
				variegated.
				Loam.
			Lithomarge.	
				Mountain soap.
			Fuller's earth.	
			Bole.	
			Reddle.	
			Yellow earth.	
			Umber.	

Appendix.

1. *Amblygonite.
2. *Bergmanite.
3. **Cereolite.*
4. **Chlorophæite.*
5. **Chusite.*
6. **Conite.*
7. *Desmine.
8. Fahlunite.
9. *Freisleben.
10. *Fuscite.
11. *Haydenite.
12. *Helvin.
13. *Humite.
14. **Limbilite.*
15. **Sideroclepte.*
16. *Sphærulite.
17. *Spinellane.
18. *Spinthere.
19. *Thulite.

*Eudialyte.
Gibbsite.
*Gieseckite.

Class III.—COMBUSTIBLES.

	Species.	Subspecies.	Varieties and	Subvarieties.
	1. *Hydrogen gas.*			
			carbureted.	
			sulphureted.	
	2. Sulphur.			
	3. *Bitumen.*			
			Naphtha.	
			Petroleum.	
			Maltha.	
			elastic.	
			Asphaltum.	
		(Retinasphaltum).		
		(Fossil copal)		
		(Hatchetine).		
	4. *Amber.*			
			earthy.	
	5. Diamond.			

Species. Subspecies. Varieties and Subvarieties.

6. Anthracite.
slaty.
granular.
conchoidal.
columnar.
(Mineral charcoal).
7. Graphite.
foliated.
granular.
8. *Coal.*
cannel.
slaty.
coarse.
sooty.
(Dysodile).
9. *Lignite.*
Jet.
brittle.
Bituminous wood.
brown.
earthy.
Aluminous earth.
10. *Peat.*
fibrous.
compact.

Class IV.—ORES.

Genus I.—*Gold.*

1. Native gold.
argentiferous.

Genus II.—*Platina.*

1. Native platina.

Genus III.—*Iridium.*

1. Native iridium.

Genus IV.—*Palladium.*

1. Native palladium.

Genus V.—*Silver.*

1. Native silver.
auriferous.
2. Antimonial silver.
3. Arsenical silver.
4. Sulphuret of silver.
cupreous.
(Silver black).
5. Cupreous seleniuret of silver.
6. Sulphureted antimonial silver.
brittle.
7. *Carbonate of silver.*
8. Muriate of silver.
argillaceous.

Genus VI.—*Mercury.*

1. *Native mercury.*
2. Argental mercury.
3. Sulphuret of mercury.
common
fibrous.
compact.
slaty.
(Bituminous cinnabar).
4. Muriate of mercury.

Genus VII.—*Copper.*

1. Native copper.
2. Sulphuret of copper.
pseudomorphous.
(Black copper).
3. Pyritous copper.
variegated.

Species. Subspecies. Varieties and Subvarieties.

4. Gray copper.
arsenical.
antimonial.
Tennantite.
(White copper).
5. Seleniuret of copper.
6. Red oxide of copper.
foliated.
capillary.
compact.
ferruginous.
7. Carbonate of copper.
blue.
earthy.
green.
fibrous.
compact.
(Copper green).
8. Anhydrous carbonate of copper.
9. Dioptase.
10. Muriate of copper.
sandy.
11. Sulphate of copper.
12. Phosphate of copper.
13. Arseniate of copper.
obtuse octahedral.
acute octahedral.
hexahedral.
prismatic.
fibrous.
earthy.
ferruginous.

Genus VIII.—*Iron.*

1. Native iron.
meteoric.
2. Arsenical iron.
argentiferous.
3. Sulphuret of iron.
common.
capillary.
cellular.
radiated.
cockscomb.
hepatic.
magnetic.
arsenical.
4. Magnetic oxide of iron.
Native magnet.
Iron sand.
earthy.
5. Specular oxide of iron.
micaceous.
6. Red oxide of iron.
scaly.
Red hæmatite.
compact.
ochry.
7. Brown oxide of iron.
scaly.
hæmatitic.
compact.
ochry.
8. *Argillaceous oxide of iron.*
columnar.
granular.
lenticular.
nodular.

Species. Subspecies. Varieties and Subvarieties.

Argillaceous oxide of iron.
common.
jaspery.
Bog ore
(Pitchy iron ore).
(Vitreous black oxide of iron).
(Stilpnosiderite).
(Blue ironstone).
(Hedenbergite).

9. Carbonate of iron.
10. Sulphate of iron.
11. Phosphate of iron.
crystallised.
earthy.
(Green iron earth).
12. Arseniate of iron.
(Skorodite).
13. Chromate of iron.
crystallised.
granular.
amorphous.
14. Muriate of iron.

Genus IX.—*Lead.*

1. *Native lead.*
2. Sulphuret of lead.
common.
granular.
compact.
specular.
striated,
antimonial.
argento-antimonial.
argento-bismuthal.
arsenical.
cobaltic.
3. Oxide of lead.
aluminous.
4. Carbonate of lead.
acicular.
columnar.
earthy.
black.
5. Carbonated muriate of lead.
6. Sulphate of lead.
7. Phosphate of lead.
acicular.
arseniated.
(Blue lead).
8. Arseniate of lead.
reniform.
9. Chromate of lead.
cupreous.
10. Molybdate of lead.
11. Tungstate of lead.

Genus X.—*Tin.*

1. Oxide of tin.
fibrous
2. *Pyritous tin.*

Genus XI.—*Zinc.*

1. Sulphuret of zinc.
yellow.
brown.
black.
fibrous.
2. Red oxide of zinc.
3. Franklinite.
4. Siliceous oxide of zinc.

Species. Subspecies. Varieties and Subvarieties

5. Carbonate of zinc.
compact.
earthy.
cupreous.
6. Sulphate of zinc.

Genus XII.—*Nickel.*

1. Native nickel.
2. Arsenical nickel.
(Black nickel).
3. *Arsenite of nickel.*

Genus XIII.—*Cobalt*

1. Arsenical cobalt.
dull.
2. Gray cobalt.
3. *Sulphuret of cobalt.*
4. *Oxide of cobalt.*
black.
brown.
yellow.
5. Sulphate of cobalt.
6. Arseniate of cobalt.
acicular.
earthy.
slaggy.
argentiferous.

Genus XIV.—*Manganese.*

1. Sulphuret of manganese.
2. Oxide of manganese.
radiated.
argentine.
compact.
earthy.
ferruginous.
3. Siliceous oxide of manganese.
4. Carbonate of manganese.
5. Phosphate of manganese.

Genus XV.—*Arsenic.*

1. Native arsenic.
concreted.
specular.
amorphous.
2. Sulphuret of arsenic.
Realgar.
Orpiment.
3. Oxide of arsenic.

Genus XVI.—*Bismuth.*

1. Native bismuth.
2. Sulphuret of bismuth.
cupreous.
plumbo-cupreous.
3. *Oxide of bismuth.*

Genus XVII.—*Antimony.*

1. Native antimony.
arsenical.
2. Sulphuret of antimony.
radiated.
foliated.
compact.
plumous.
argentiferous.
nickeliferous.
cupreous.
3. Oxide of antimony.
earthy.
(ferruginous).
4. Sulphureted oxide of antimony

Species. Subspecies. Varieties and Subvarieties.

Genus XVIII.—*Tellurium.*

1. Native tellurium.
   auro-argentiferous.
   auro-plumbiferous.

Genus XIX.—*Chrome.*

1. Oxide of chrome.

Genus XX.—*Molybdena.*

1. Sulphuret of molybdena.
2. *Oxide of molybdena.*

Genus XXI.—*Tungsten.*

1. Yellow oxide of tungsten.
2. Calcareous oxide of tungsten.
3. Ferruginous oxide of tungsten.

Genus XXII.—*Titanium.*

1. Red oxide of titanium.
   reticulated.
2. Ferruginous oxide of titanium.
   Menachanite.
   Nigrine.
   Iserine.
   (Crichtonite).
3. Silico-calcareous oxide of titanium.
4. Octahedral oxide of titanium.

Genus XXIII.—*Uranium.*

1. Black oxide of uranium.

Species. Subspecies. Varieties and Subvarieties.

2. Green oxide of uranium.
   crystallised.
   earthy.

Genus XXIV.—*Columbium.*

1. Ferruginous oxide of columbium.
2. Yttrious oxide of columbium.

Genus XXV.—*Cerium.*

1. *Siliceous oxide of cerium.*
2. Allanite.
3. Fluate of cerium.
   neutral.
   Subfluate.
   yttrious.
   (Yttrocerite).

Genus XXVI.—*Selenium.*

Genus XXVII.—*Cadmium.*

We add, in justice to some brilliant discoveries of that philosopher, the following tables, exhibiting the effects of polarised light on various mineral substances, by Dr. Brewster. They appeared in his Edinburgh Philosophical Journal, to which we have to acknowledge those numerous obligations which have rendered its discontinuance a matter of unfeigned regret to us.

I.—List of Absorbing Crystals with One Axis.

Names of crystals.	Color when its axis is in the plane of primitive polarisation.	Color when its axis is perpendicular to that plane.
Zircon	Brownish white	A deeper brown
Sapphire	Yellowish green	Blue
Ruby	Pale yellow	Bright pink
Emerald	Yellowish green	Bluish green
Emerald	Bluish green	Yellowish green
Beryl blue	Bluish white	Blue
Beryl green	Whitish	Bluish green
Beryl yellow green	Pale yellow	Pale green
Rock crystal, almost transparent	Whitish	Faint brown
Rock crystal yellow	Yellowish white	Yellow
Amethyst	Blue	Pink
Amethyst	Grayish white	Ruby red
Amethyst	Reddish yellow	Ruby red
Tourmaline	Greenish white	Bluish green
Rubellite	Reddish white	Faint red
Idocrase	Yellow	Green
Mellite	Yellow	Bluish white
Phospnate of lime (lilac)	Bluish	Reddish
——————— (olive)	Bluish green	Yellowish green
Phosphate of lead	Bright green	Orange yellow
Calcareous spar	Orange yellow	Yellowish white

The property which these crystals possess of absorbing the different tints in different positions of the axis, with regard to the plane of primitive polarisation, does not belong to every specimen. There are many crystals of ruby, sapphire, emerald, &c., which give an ordinary and an extraordinary image of the same color; and, whenever this is the case, they are destitute of the property of absorbing polarised light. These two classes of phenomena are indeed invariably connected, and will ultimately be found to have the same origin.

II.—List of Absorbing Crystals with Two Axes.

	Plane of the resultant axes in the plane of primary polarisation.	Plane of the resultant axes perpendicular to the plane of primary polarisation.
Topaz blue	White	Blue
—— green	White	Green
—— grayish blue	Reddish gray	Blue
—— pink	Pink	White
—— pink yellow	Pink	Yellow
—— yellow	Yellowish white	Orange
Sulphate of barytes		
—— yellowish purple	Lemon yellow	Purple
—— yellow	Lemon yellow	Yellowish white
—— orange yellow	Gamboge yellow	Yellowish white
Kyanite	White	Blue
Dichroite	Blue	Yellowish white
Cymophane	Yellowish white	Yellowish
Epidote olive green	Brown	Sap green
—— whitish green	Pink white	Yellowish white
Mica	Reddish brown	Reddish white

III.—The following Table shows the Characters of the Tints in Crystals with Two Axes which have not been examined in every azimuth.

	Axis of prism in the plane of primitive polarisation.	Axis of prism perpendicular to the plane of primitive polarisation.
Mica	Blood red	Pale greenish yellow
Acetate of copper	Blue	Greenish yellow
Muriate of copper*	Greenish white	Blue
Olivine	Bluish green	Greenish yellow
Sphene	Yellow	Bluish
Nitrate of copper	Bluish white	Blue
Chromate of lead	Orange	Blood red
Staurotide	Brownish red	Yellowish white
Augite	Blood red	Bright green
Anhydrite	Bright pink	Pale yellow
Axinite	Reddish white	Yellowish white
Diallage	Brownish white	White
Sulphur	Yellow	Deeper yellow
Sulphate of strontites	Blue	Bluish white
—— cobalt	Pink	Brick red
Olivine.	Brown	Brownish white

In the last eight crystals of the preceding table the tints are not given in relation to any fixed line.

IV.—The following Table contains the Characters of the Two Pencils in Crystals the number of whose axes I have not yet determined.

Phosphate of iron	Fine blue †	Bluish white
Actinolite	Green	Greenish white
Precious opal	Yellow	Lighter yellow
Serpentine	Dark green	Lighter green
Asbestos	Greenish	Yellowish
Blue carbonate of copper	Violet blue	Greenish blue
Octohedrite (*one axis*).	Whitish brown	Yellowish brown

MINERVA, ATHENA, or PALLAS, in Pagan worship, the goddess of sciences and of wisdom, who sprung completely armed from Jupiter's brain; and on the day of her nativity it rained gold at Rhodes. She disputed with Neptune the honor of giving a name to the capital of Cecropia, when they agreed that whosoever of them should produce what was most useful to mankind, should have that advantage. Neptune, with a stroke of his trident, formed a horse; and Minerva caused an olive to spring from the ground, which was judged by the unanimous voice of the gods to be the most useful, from its being the symbol of peace; whereupon she gave her name Athenæ to the city, and became its tutelar goddess. Minerva changed Arachnè into a spider, for pretending to excel her in making tapestry. She fought the giants; favored Cadmus, Ulysses, and other heroes; and refused to marry Vulcan, choosing rather to live in a state of celibacy. She also deprived Tiresias of sight, turned Medusa's locks into snakes, and performed several other exploits. Minerva is usually represented by the poets, painters, and sculptors, completely armed, with a composed but agreeable countenance, bearing a golden breast-plate, a spear in her right hand, and her ægis or shield in the left, on which is represented Medusa's head encircled with snakes, and her helmet usually entwined with olives. Minerva had several temples both in Greece and Italy. The usual victim offered her was a white heifer, never yoked. The animals sacred to her were the cock, the owl, and the basilisk.

MINERVÆ ARX, MINERVÆ CASTRUM, MINERVIUM, or Templum Minervæ, a citadel, temple, and town on the Ionian Sea, beyond Hydrus; seen a great way out at sea, now called Castro, a town of Otranto in Naples. Long. 19° 25′ E., lat. 46° 8′ N.

MINERVÆ PROMONTORIUM, in ancient geography, the seat of the Sirens, a promontory of Italy, in the Sinus Paestanus, the south boundary of Campania on the Tuscan coast; so called from a temple of Minerva on it: situated south of Surrentum, and therefore called Surrentinum: now Capo della Minerva, on the west coast of Naples, over against the island Capri.

MINERVALIA, in Roman antiquity, festivals celebrated in honor of Minerva; in March the scholars had a vacation, and usually made a present to their masters, called from this festival Minerval.

MIN'GLE, *v. a.*, *v. n.* & *n. s.* Sax. mengen; Teut. and Belg. *mengen, mengelen*; Goth. *meinga*. To mix, unite, compound; hence to join dissimilar things; to confuse; to contaminate: as a neuter verb, to be mixed or united with: as a substantive it is used as synonymous with mixture, medley, confused accumulation or mass.

Alcimus had defiled himself wilfully in the times of their *mingling* with the Gentiles. 2 *Mac.* xiv. 13.

Ourself will *mingle* with society,
And play the humble host.
Shakspeare. Macbeth.

Trumpeters,
With brazen din blast you the city's ear,
Make *mingle* with our rattling tabourines. *Id.*

Sulphurous and nitrous foam
They found, they *mingled*, and with subtle art,
Concocted and adusted, they reduced
To blackest grain. *Milton.*

To confound the race
Of mankind in one root, and Earth with Hell
To *mingle* and involve. *Id.*

Neither can I defend my Spanish Fryar; though the comical parts are diverting, and the serious moving, yet they are of an unnatural *mingle*.
Dryden's Dufresnoy.

Lament with me! with me your sorrows join,
And *mingle* your united tears with mine! *Walsh.*

Nor priests, nor statesmen,
Could have completed such an ill as that,
If women had not *mingled* in the mischief.
Rowe.

She, when she saw her sister nymphs, suppressed
Her rising fears, and *mingled* with the rest.
Addison.

The best of us appear contented with a *mingled* imperfect virtue. *Rogers's Sermons.*

Our sex, our kindred, our houses, and our very names, we are ready to *mingle* with ourselves, and cannot bear to have others think meanly of them.
Watts's Logic.

To have fought together in such a cause—to have *mingled* banners, and to have *mingled* blood in battles of such interests, and leading to such results, must undoubtedly cement an eternal union between the British and Portuguese nations. *Canning.*

MINGRELIA, a part of Western Georgia, in Asia, anciently called Colchis; bounded on the east by Iberia, or Georgia properly so called; on the west by the Euxine Sea; on the south by Armenia, and part of Pontus; and on the north by mount Caucasus. It is watered by many rivers, particularly the Corex, the Hippus, the Cyaneus, the Charistus, the Phasis, where the Argonauts landed, the Absarus, the Cissa, and the Ophis, all running into the Euxine Sea. The whole kingdom of Colchis was in ancient times very pleasant and fruitful, as it is still where duly cultivated; abounding in all the necessaries of life; and was enriched with many mines of gold, which gave occasion to the fable of the Golden Fleece and the Argonautic expedition, so much celebrated by the ancients. Sir John Chardin tells us, that this country extends above 100 miles in length and sixty in breadth; being not nearly so extensive as the ancient Colchis, which reached from the frontiers of Iberia or Georgia Proper, west to the Palus Mæotis: that it is beautifully diversified with hills, mountains, valleys, woods, and plains, but badly cultivated: that besides vines, all kinds of fruits found in England grow wild, but tasteless for want of culture: that there are many rivers which rise in mount Caucasus, particularly the Phasis, now called the Rione: that the country abounds with beeves, hogs, wild boars, stags, partridges, pheasants, and quails: that falcons, eagles, pelicans, lions, leopards, tigers, wolves, and jackals, breed on mount Caucasus, and sometimes greatly annoy the country: that the people are generally handsome, the men strong and well made, and the women very beautiful; but both sexes very debauched: that they marry their nieces, aunts, or other near relations, indifferently; and take as many wives and concubines as they please: that they not only sell their children, but even murder them, or bury them alive, when they find it difficult to bring them up: that

they use a sort of paste, made of a plant called gom, instead of bread; but that of the superior ranks consists of wheat, barley, or rice: that the gentry have an absolute power over their vassals, extending to life, liberty, and estate: that their arms are bows and arrows, lances, sabres, and bucklers; that they eat sitting cross-legged upon a carpet, like the Persians; but the poorer sort upon a mat or bench: that the country is very thin of inhabitants, no fewer than 12,000 being sold yearly to the Turks and Persians: that the principal commodities exported from it are honey, wax, hides, castor, skins, flax-seed, thread, silk, and linen cloth; but there are now no gold or silver mines, and very little money: that the annual revenue of the viceroy amounts to about 20,000 crowns: that the inhabitants call themselves Christians; but that they and their priests are altogether ignorant of the doctrines of Christianity: that their bishops are rich, have a great number of vassals, and are clothed in scarlet and velvet: and that their service is according to the rites of the Greek church, with a mixture of Judaism and Paganism. The cities of most note in this country in ancient times were Pityus; Dioscurias, or Dioscorias, so called from Castor and Pollux, by whom it is said to have been founded, and who in Greek are styled Διοσκυροι, now called Savatapoli; Aea on the Phasis, supposed to be Hupolis; Phasis, so called from the river; Cyta, at the mouth of the Cyaneus, the birthplace of Medea, called thence, by the poets, Cytæis; Saracæ, Zadris, Surium, Madia, and Zolissa. As for modern cities, there are none worthy of a description known to Europeans.

MIN'IATURE, *n. s.* Fr. *miniature;* Span. *miniatura;* Lat. *minio*, to paint with minium. Perhaps, originally, painting with powders mixed with gum and water, first appropriated to small figures: diminutive representation. But see another etymology in the article.

The water, with twenty bubbles, not content to have the picture of their face in large, would in each of these bubbles set forth the *miniature* of them.
Sidney.

The hidden ways
Of nature would'st thou know; 'how first she frames
All things in *miniature?* thy specular orb
Apply to well dissected kernels: lo!
Strange forms arise, in each a little plant
Unfolds its boughs: observe the slender threads
Of first beginning trees, their roots, their leaves,
In narrow seeds described. *Philips.*

If the ladies should once take a liking to such a diminutive race, we should see mankind epitomised, and the whole species in *miniature*: in order to keep our posterity from dwindling, we have instituted a tall club. *Addison's Guardian.*

Here shall the pencil bid its colors flow,
And make a *miniature* creation grow. *Gay.*

MINIATURE PAINTING is a delicate kind of painting, in which the subjects are represented on a very small scale. The word comes from the French mignature, from mignon, fine or pretty, on account of its smallness and delicacy; and it may be ultimately derived from μικρος, small, or minimus, least. Miniature is distinguished from other kinds of painting by the smallness and delicacy of its figures; on which account it requires to be viewed very closely.—As many persons wish to amuse themselves with painting in miniature, who know little or nothing of the principles of drawing or painting, various methods have been invented, such as copying by squares, on oiled paper, &c. Perhaps one of the best mechanical inventions to assist such persons is the mathematical compass called a PENTAGRAPH, which see. See also DRAWING and PAINTING.

For a long time miniature painting was employed upon vellum, paper, &c.; but, in the present improved state of the art, ivory is more used than any of these materials. Yet ivory being a solid substance, and wanting that absorbent surface which constitutes the excellence of vellum, it renders the management of the colors much more difficult and laborious. No tints can be produced by the expeditious mode of washing; but all must be done by dint of labor, by dotting or hatching. Gumming is the next expedient resorted to, to fix the first lays in order to take the subsequent colors; and so on till the work is finished. In conseqence of these difficulties, so perplexing to every artist, miniature painters have of late confined themselves chiefly to portrait painting, and the higher branch of history has been much neglected. This obstacle to historical painting in miniature is now however likely to be done away; Mr. Einsle, an ingenious artist in London, having discovered a method of producing, by a chemical process, a white skinny surface on the ivory, at once smooth and absorbent, so as to unite all the qualities required for washing and painting upon it, in the same manner as on vellum. The colors, when properly ground and mixed up with gum, produce a gloss without the assistance of gumming; and admit of being laid on one lay after another to any depth, without removing those underneath. To the same artist we are indebted for a peculiar preparation of the colors usually employed in miniature painting; which are both superior to the old, and fewer in number. The chief colors made use of for painting in miniature are, carmine; Venice and Florence lake; rose pink; vermilion; red lead; brown red; red orpiment; ultramarine; verditer; indigo; gallstone; yellow ochre; Dutch pink; gamboge; Naples yellow; pale masticot; deep yellow masticot; ivory black; lamp black; true Indian ink; bistre or wood-soot; raw umber; burnt umber; sapgreen; verdigris; and flake white. Most of these colors may easily be prepared by attending to the directions given under the article COLOR-MAKING. But they can all be had ready prepared, in complete sets, from the color shops. Provide an ivory pallet, very smooth, as big as your hand; on one side of which the colors for the carnation, or naked parts of a picture, are to be arranged thus: in the middle put a great deal of white, pretty largely spread; because it is the color most made use of: and upon the edge, from the left to the right, place the following colors at a little distance from the white: Masticot; Dutch pink; orpiment; yellow ochre; green, composed of verditer, Dutch pink, and white, in equal quantities; blue, made of ultramarine, indigo, and white, to a great degree of paleness;

vermilion; carmine, bister, and black On the other side of the pallet, spread some white in the same manner as for the carnation. When draperies, or the like, are to be painted, place near the white the color they are to be made of. To work well in minature, it must be done in a room that has but one window, with a table and desk almost as high as the window. The painter must place himself near it, in such a manner that the light may always come in on the left side, and never forwards or on the right. To lay the color on all parts equally strong, as for a ground, make the mixtures in shells, and put in enough for the thing to be painted; for, if there be not enough, it is a great chance but the color mixed afterwards is too dark or too light. Begin by dead coloring, i.e. by laying the colors on with liberal strokes of the pencil, in the smoothest manner, as the painters do in oil; not giving it all the force it is to have for a finishing. Make the lights a little brighter, and the shades less dark, than they ought to be; because in dotting upon them, as must be done after dead coloring, the color is always fortified, and would at last be too dark. There are several ways of dotting. Some make their dots perfectly round; others a little longish; others hatch by little strokes that cross each other every way, till the work appears as if it had been wrought with dots. This last method is the best, the boldest, and the soonest done: therefore learners ought to use it, and to inure themselves from the first to dot in the plump and the soft way; that is, where the dots are lost, in a manner, in the ground, and only so much appears as is sufficient to make the work seem dotted. The hard and dry way is quite the reverse, and always to be avoided, as it makes the work seem rough and uneven. Study likewise to lose and drown the colors one in another, so that it may not appear where they disjoin; and, to this end, soften or allay the touches with colors that partake of both, so that it may not appear to be the touches which cut and disjoin them. By the word cut is meant what manifestly separates and divides, and does not run in and blend itself with the neighbouring colors; which is rarely practised but upon the borders of drapery. When the pieces are finished, to heighten them a little, and give them a fine air, give, upon the extremity of the lights, small touches with a color yet lighter, which must be gradually lost with the rest. When the colors are dry upon the pallet or in the shells, they must be diluted with water. And when they want gum, which is seen when they easily rub off the hand or the vellum, they must be tempered with gum water instead of pure water, till they are in condition. See PAINTING.

MIN'IKIN, *adj.* & *n. s.*, MIN'IM, *n. s.*, MIN'IMUS. Goth. Belg. and Teut. *min;* Lat. *minus, minimus.* Small, diminutive: any thing or person very small; a dwarf.

Sleepest, or wakest thou, jolly shepherd?
Thy sheep be in the corn;
And for one blast of thy *minikin* mouth,
Thy sheep shall take no harm.
Shakspeare. King Lear.

Get you gone you dwarf;
You *minimus*, of hind'ring knot grass made;
You bead, you acorn. *Id.*

MINIM, a character or note in music, equal in duration to the sixteenth part of a large, one eighth of a long, one fourth of a breve, and one half of a semi-breve

MINIMS, a religious order in the church of Rome, founded by St. Francis de Paula, towards the end of the fifteenth century. Their habit is a coarse black woollen stuff, with a woollen girdle, of the same colors, tied in five knots. They are not permitted to quit their habit and girdle night nor day. Formerly they went barefooted, but are now allowed the use of shoes.

MINIMUM, in the higher geometry, the least quantity attainable in a given case.

MIN'ION, *n. s.* Teut. *minion;* Fr. *mignon;* the root Mr. Thomson thinks is the Gothic *ven* or *min*, affection, love. A favorite; an insignificant or low dependent; a contemptuous cognomen.

Minion, said she; indeed I was a pretty one in those days; I see a number of lads that love you. *Sidney.*

They were made great courtiers, and in the way of *minions*, when advancement, the most mortal offence to envy, stirred up their former friend to overthrow them. *Sidney.*

One who had been a special *minion* of Andromanas, hated us for having dispossessed him of her heart. *Id.*

Go rate thy *minions*;
Becomes it thee to be thus bold in terms
Before thy sovereign? *Shakspeare. Henry VI.*

Edward sent one army into Ireland; not for conquest, but to guard the person of his *minion*, Piers Gaveston. *Davies.*

If a man should launch into the history of human nature, we should find the very *minions* of princes linked in conspiracies against their master. *L'Estrange.*

The drowsy tyrant by his *minions* led,
To regal rage devotes some patriot's head.
Swift.

I speak of the neglected many, whose nerves, whose sinews, whose days, are sold to the *minions* of fortune. *Burns.*

MIN'IOUS, *adj.*, MIN'IUM, *n. s.* Lat. *minium.* Of the color of red lead: red lead.

Some conceive that the Red Sea receiveth a red and *minious* tincture from springs that fall into it. *Brown.*

Melt lead in a broad earthen vessel unglazed, and stir it continually till it be calcinated into a gray powder; this is called the calx of lead; continue the fire, stirring it in the same manner, and it becomes yellow; in this state it is used in painting, and is called masticot or massicot; after this put it into a reverberatory furnace, and it will calcine further, and become of a fine red, which is the common *minium* or red lead: among the ancients *minium* was the name for cinnabar; the modern *minium* is used externally, and is excellent in cleansing and healing old ulcers.

MIN'ISH, *v. a.* From diminish, or Gothic *minn;* Lat. *minus, minuo.* To make small or smaller; to lessen, impair; lop, clip.

Ye shall not *minish* ought from your bricks of your daily task. *Exod.* v. 19.

They are *minished* and brought low through oppression. *Psalm* cvii. 39.

Another law was to bring in the silver of the realm to the mint, in making all clipt, *minished*, or impaired coins of silver, not to be current in payments. *Bacon's Henry VII.*

MIN'ISTER, *n. s., v. a. & v. n.* Fr. *ministre*; Ital. Span. and Port. *ministro*; Lat. *minister*. An agent, attendant, assistant, servant; particularly a servant of God in any of the offices of the church; a servant of the king or state; a member of the administrative government; an official; a delegate: to minister is to supply, give, or afford; and, as a neuter verb, to attend, serve in any office; give supplies: ministerial and ministrant mean, attendant; acting under command or agency; sacerdotal; official: a ministerialist, in political affairs, is an adherent, or writer in favor of an administration: ministral, pertaining to a minister, or a ministry: ministration, agency; operation or influence; intervention; dispensation of God's will; ecclesiastical service: ministry, office; service; particularly of the church; administrative part of a government; business.
MINISTE'RIAL, *adj.*
MINISTE'RIALIST, *n. s.*
MINISTE'RIALLY, *adv.*
MIN'ISTRAL, *adj.*
MIN'ISTRANT,
MINISTRA'TION, *n. s.*
MIN'ISTRY,

His modir seith to the *mynystris*, whatever thing he seye to you, do ye. *Wiclif. Jon.* 2.

Others *ministered* unto him of their substance. *Luke.*

Whether prophecy, let us prophesy according to the proportion of faith; or *ministry*, let us wait on our *ministering*. *Rom.* xii. 7.

Now he that *ministereth* seed to the sower, both *minister* bread for your food, and multiply your seed sown. 2 *Cor.* ix.

Epaphras, a faithful *minister* of Christ. 1 *Col.* i. 7.

You, whom virtue hath made the princess of felicity, be not the *minister* of ruin. *Sidney.*

These speeches of Jerom and Chrysostom plainly allude unto such *ministerial* garments as were then in use. *Hooker.*

Can'st thou not *minister* to a mind diseased,
Pluck from the memory a rooted sorrow,
Raze out the written troubles of the brain? *Shakspeare. Macbeth.*

Rumble thy belly full; spit fire! spout rain!
Nor rain, wind, thunder, fire, are my daughters;
I tax not you, you elements, with unkindness:
But yet I call you servile *ministers*,
That have with two pernicious daughters joined
Your high-engendered battles, 'gainst a head
So old and white as this. *Id. King Lear.*

If wrongfully,
Let God revenge; for I may never lift
An angry arm against his *minister*. *Shakspeare.*

Kings must be answerable to God; but the *ministers* to kings, whose eyes, ears, and hands they are, must be answerable to God and man. *Bacon.*

For the *ministerial* officers in court there must be an eye upon them. *Bacon's Advice to Villiers.*

The faithful *minister* provideth not only wholesome but plentiful food for his people. *Fuller.*

They that will have their chamber filled with a good scent, make some odoriferous water be blown about it by their servants' mouths that are dexterous in that *ministery*. *Digby.*

God made him the instrument of his providence to me, as he hath made his own land to him, with this difference, that God, by his *ministration* to me, intends to do him a favor. *Taylor.*

A *ministerial* headship or the prime *minister* cannot in any capacity become the foundation of the church to any such purpose. *Jer. Taylor.*

At table Eve
Ministered naked, and their flowing cups
With pleasant liquors crowned. *Milton.*

This temple to frequent
With *ministeries* due, and solemn rites. *Id.*

Him thrones, and powers,
Princedoms, and dominations *ministrant*,
Accompanied to heaven-gate. *Id. Paradise Lost.*

Their *ministry* performed, and race well run,
Their doctrine and their story written left,
They die. *Id.*

Though sometimes effected by the immediate fiat of the divine will, yet I think they are most ordinarily done by the *ministration* of angels. *Hale's Origin of Mankind.*

Unto him it *ministereth* a free address upon all occasions, with him it alloweth us continually a most sweet and pleasant intercourse. *Barrow.*

Understanding is in a man; courage and vivacity in the lion's service, and *ministerial* officiousness in the ox. *Browne.*

The wounded patient bears
The artist's hand, that *ministers* the cure. *Otway.*

The infernal *minister* advanced,
Seized the due victim. *Dryden.*

He safe from loud alarms,
Abhorred the wicked *ministry* of arms. *Id.*

There is no truth which a man may more evidently make out than the existence of a God; yet he that shall content himself with things as they *minister* to our pleasures and passions, and not make enquiry a little farther into their causes and ends, may live long without any notion of such a being. *Locke.*

Saint Paul was miraculously called to the *ministry* of the gospel, and had the whole doctrine of the gospel from God by immediate revelation; and was appointed the apostle of the Gentiles for propagating it in the heathen world. *Id.*

So far is an indistinction of all persons, and, by consequence, an anarchy of all things, from being agreeable to the will of God declared in his great household, the world, and especially in all the *ministries* of his proper household the church, that there was never yet any time, I believe, since it was a number, when some of its members were not more sacred than others. *Sprat's Sermons.*

He who has a soul wholly void of gratitude, should set his soul to learn of his body; for all the parts of that *minister* to one another. *South.*

To all but thee in fits he seemed to go,
And 'twas my *ministry* to deal the blow. *Parnel.*

The *ministers* are always preaching, and the governors putting forth edicts against dancing and gaming. *Addison.*

Fasting is not absolutely good, but relatively, and as it *ministers* to other virtues. *Smalridge's Sermons.*

From essences unseen, celestial names,
Enlightening spirits, and *ministerial* flames,
Lift we our reason to that sovereign cause,
Who blessed the whole with life. *Prior.*

Abstinence, the apostle determines, is of no other real value in religion, than as a *ministerial* cause of moral effects as it recalls us from the world, and gives a serious turn to our thoughts. *Rogers.*

The *ministers* of the gospel are especially required to shine as lights in the world, because the distinction of their station renders their conduct more observable; and the presumption of their knowledge, and the dignity of their office, give a peculiar force and authority to their example. *Id.*

Those good men, who take such pleasure in re-

lieving the miserable for Christ's sake, would not have been less forward to *minister* unto Christ himself.
Atterbury.

If the present *ministration* be more glorious than the former, the *minister* is more holy. *Id.*

Other spirits governed by the will,
Shoot through their tracks, and distant muscles fill;
This sovereign, by his arbitrary nod,
Restrains or sends his *ministers* abroad. *Blackmore.*

Supremacy of office, by mutual agreement, and voluntary œconomy, belongs to the father; while the son, out of voluntary condescension, submits to act *ministerially*, or in capacity of mediator.
Waterland.

The poets introduced the *ministry* of the gods, and taught the separate existence of human souls.
Bentley.

Ministrant to their queen with busy care,
Four faithful handmaids the soft rites prepare.
Pope.

I converse in full freedom with many considerable men of both parties; and if not in equal number, it is purely accidental, as happening to have made acquaintance at court more under one *ministry* than another. *Swift.*

Calidus contents himself with thinking that he never was a friend to hereticks and infidels; that he has always been civil to the *minister* of his parish, and very often given something to the charity-schools.
Law.

The profession of a clergyman is an holy profession, because it is a *ministration* in holy things, an attendance at the altar. *Id.*

Yet if I could collect my faultering breath,
Well were I meet for such sad *ministry*,
For grief hath left my voice no other sound.
Maturin.

A MINISTER, in the presbyterian ecclesiastical polity, is a clergyman, who preaches, performs religious worship in public, administers the sacraments, &c.

MINISTER, FOREIGN, is a person sent into a foreign country, to manage the affairs of his province, or of the state to which he belongs. Of these there are two kinds: those of the first rank are ambassadors and envoys extraordinary, who represent the persons of their sovereigns; the ministers of the second rank are the ordinary residents.

MINIUM, or red lead, is an oxide of lead of a vivid red color, which it acquires by a slow calcination and reverberation. See CHEMISTRY, Index. The minium in commerce is chiefly brought from Holland, where large quantities of it are manufactured. The method in which minium is made in large quantities with us is this: they first burn lead in a furnace into a kind of litharge, by continually stirring it while melted with an iron rake; this they afterwards grind with two pairs of stones, which deliver it from one to another; the first pair grinding it coarser, the second finer; these are worked by means of a mill, which moves six pairs of them at once. When thus reduced to a fine powder, it is washed and then put into a furnace, and is burnt with a reverberatory fire for two or three days; all the while they continue stirring it with a large iron rake, hung on a swivel or iron hook; and toward the end of the time they watch its color. When this is doing, the fire must not be carried beyond a certain degree, lest the matter clot and run together. The furnace is of the reverberatory kind, with two fire-places at the ends; each fire-place being separated from the area, or body of the furnace, by a wall twelve inches high. The fire-places are fifteen inches broad, and their length is equal to the breadth of the whole furnace, which is about eight or nine feet. The length of the area, from one place to the other, is nine or ten feet. The quantity of lead used in one operation is about 1500 lbs., of which nine parts are lead obtained from furnaces where the ore is smelted, and one part is lead extracted from the scoria which is formed in smelting the ore. This latter kind is said to be necessary, as the former could not alone be reduced into powder. All the lead is at once put into the area, the bottom of which is level. The calx, as fast as it is formed, is drawn to one side, by a rake suspended by a chain before the mouth of the furnace. In four or five hours the whole quantity of the lead is calcined, or, if any pieces remain uncalcined, they are separated, and kept for the next operation. The heat employed is that of a cherry red; and the fire-places and mouth are kept open that the air may accelerate the calcination. The calx is to be frequently stirred to prevent its concreting; and, when this operation has been continued about twenty-four hours, the matter is taken out of the furnace, and laid on a flat pavement. Then cold water is thrown on it, to give it weight, as the workmen say; but rather, as Mr. Jars thinks, to make it friable. It is then to be ground in a mill, and the finer part is separated by washing, while the coarser part, reserved for some following operation, is to be placed at the mouth of the furnace in order to retain the melted lead. The fine powder, which is now of a yellow color, is again put into the same or a similar furnace, and exposed to a very moderate fire, from thirty-six to forty-eight hours; during which time it is stirred frequently to prevent its concreting; and the powder gradually acquires its proper red color. The minium is then to be taken out of the furnace, cooled, and sifted through an iron sieve placed in a cask. The bright color of minium might render it valuable in painting, if it could stand with certainty in either oil or water. But, as it is subject to become black, it cannot be safely trusted, except in hard varnishes; and is, therefore, seldom used in oil, or even in water, unless for very gross purposes, or as a ground for vermilion. The goodness of minium may be distinguished by the brightness of its color; and the adulteration to which it is liable may be detected by putting an ounce of it into a crucible with an equal quantity of charcoal dust, well mixed together, and placing the crucible in a common fire sufficient to melt lead, which is to be covered with another small crucible inverted into it. When it has been continued for some time on the fire, take it out and strike it against the ground. The minium will thus be reduced to its metallic state; and its diminished weight, when freed from the charcoal dust, &c., will indicate the proportion of adulterated matter. Minium is also used as a flux in forming the enamel for grounds, and in glazing, &c. It is now called red oxide.

MINNIN, a stringed instrument of music among the ancient Hebrews, having three or four chords to it. There is reason to question the antiquity of this instrument; both because it requires a hair-bow, which was a kind of plectrum not known to the ancients, and because it so much resembles the modern viol. Kircher took the figures of this, the machul, chinor, and psaltery, from an old work in the Vatican library.

MIN'NOCK, *n. s.* Sax. man or mȳn and oᵹ: Goth. *ug*, a boy. An elf or mischievous urchin: It is not unlikely, as Dr. Johnson says, that minnock and minx were originally the same word.

MI'NNOW, *n. s.* Fr. *menue*; Span. *mena*, of Lat. *minus*. A very small fish.

MINK (*mustela*). The animal known in the United States under the name of *mink* is so similar to the European quadruped of the same name that they have been generally confounded with each other. The common name of both species is derived from the Swedish *menk*. The American animal is the *M. vison* of naturalists, and is generally to be found on the banks of streams, especially near farm-houses and mills. It swims and dives well, and can remain under water for a considerable time. It preys upon small fish, muscles, &c., but also commits depredations on the poultry yard, and will devour rats, mice, &c. The mink, when irritated, exhales a very fetid smell, almost equal to that of the skunk. It is easily tamed, and is capable of strong attachment, but, like the cat kind, is readily offended, and will bite on a sudden provocation. The fur is of little value.—The European mink (*M. lutreola*) inhabits the northern parts of Europe, and, like the American species, lives on the banks of streams, feeding on frogs, craw-fish, &c. It is of a brownish-red color. It has a strong musky smell, and its fur is very fine.

The MINNOW is a species of Cyprinus.

MI'NOR, *adj.* & *n. s.*
MI'NORATE, *v. a.*
MINORA'TION, *n. s.*
MINOR'ITY.
} Lat. *minor*; Fr. *minorité*; Ital. *minorita*; Span. *minoridad*. Little, petty; inconsiderable; less: a person under age; a legal infant; the second or inferior proposition of a syllogism: to minorate, is to make less or diminish: minoration, the act of lessening. (Both this verb and noun are of questionable authority.) Minority, the state of being less; the smaller number; state of being under age.

I moved the king, my master, to speak in the behalf of my daughter, in the *minority* of them both. *Shakspeare.*

The second or *minor* proposition was, that this kingdom hath cause of just fear of overthrow from Spain. *Bacon.*

Henry the Eighth, doubting he might die in the *minority* of his son, procured an act to pass, that no statute made during the *minority* of the king should bind him or his successors, except it were confirmed by the king at his full age. But the first act that passed in king Edward the Sixth's time was a repeal of that former act; at which time nevertheless the king was *minor*. *Id.*

King Richard the Second, the first ten years of his reign, was a *minor*. *Davies on Ireland.*

These changes in religion should be staid, until the king were of years to govern by himself: this the people apprehending worse than it was, a question was raised, whether, during the king's *minority*, such alterations might be made or no. *Hayward.*

It is the affection of too early ripeness that makes them prodigal of their children's safety and hopes; for, that they may be wise betimes, they send them forth to the world in the *minority* both of age and judgment. *Bp. Hall.*

They altered this custom from cases of high concernment to the most trivial debates, the *minor* part ordinarily entering their protest. *Clarendon.*

This it doth, not only by the advantageous assistance of a tube, but by showing in what degrees distance *minorates* the object. *Glanville.*

If there are petty errours and *minor* lapses, not considerably injurious unto faith, yet it is not safe to contemn inferior falsities. *Browne.*

We hope the mercies of God will consider our degenerated integrity unto some *minoration* of our offences. *Id.*

From this narrow time of gestation may ensue a *minority*, or smallness in the exclusion. *Id.*

Their counsels are warlike and ambitious, though something tempered by the *minority* of their king. *Temple.*

If there be evidence that it is not many ages since nature was in her *minority*, this may be taken for a good proof that she is not eternal. *Burnet's Theory of the Earth.*

Though we seem grieved at the shortness of life in general, we are wishing every period of it at an end. The *minor* longs to be at age, then to be a man of business, then to make up an estate, then to arrive at honors, then to retire. *Addison.*

A *minor* or infant cannot be said to be contumacious, because he cannot appear as a defendant in court, but by his guardian. *Ayliffe's Parergon.*

He and his muse might be *minors* but the libertines are full grown. *Collier's View of the Stage.*

He supposed that a philosopher's brain was like a forest, where ideas are ranged like animals of several kinds; that the major is the male, the *minor* the female, which copulate by the middle term, and engender the conclusion. *Arbuthnot.*

Long as the years dull circle seems to run,
When the brisk *minor* pants for twenty-one.
Pope.

The noblest blood of England having been shed in the grand rebellion, many great families became extinct, or supported only by *minors*. *Swift.*

MINOR, in law, denotes a person under age; or who, by the laws of the country, is not arrived at the power of administering his own affairs, or the possession of his estate. Among us, a person is a minor till the age of twenty-one; before which time his acts are invalid. See AGE, INFANT. It is a maxim in the common law that in the king there is no minority, and therefore he hath no legal guardian; and his royal grants and assents to acts of parliament are good, though he has not, in his natural capacity, attained the legal age of twenty-one. It is also provided, by the custom and law of parliament, that no one shall sit or vote in either house, unless he be twenty-one years of age. This is expressly declared by stat. 7 and 8 Will. III cap. 25, with regard to the house of commons.

MINOR, in logic, is the second proposition of a formal or regular syllogism, called also the assumption.

MINORS, in music, is applied to certain con-

cords, which differ from or are lower than others of the same denomination, by a less semitone or four commas. Thus we say, a third minor or less third, or a sixth major and minor. Concords that admit of major and minor, i. e. greater and less, are said to be imperfect concords. See MAJOR.

MINORS, FRIARS, MINOR, or MINORITES, appellations which the Franciscans assume. See FRANCISCANS. There is also an order of Regular Minors at Naples, which was established in 1588, and confirmed by Sixtus V.

MINORCA, the second of the Baleares islands, belonging to Spain, is forty miles long, north-west and south-east, and twelve broad, containing 800 square miles. The channel between it and Majorca, in the narrowest part between Capes Pera and d'Artush, is thirty miles. Minorca was taken by the English in 1708, and confirmed to them by the treaty of Utrecht, 1713. In 1756 it was retaken by the Spaniards and French, and admiral Byng fell a victim to the exasperation of the public mind, and to the safety of ministers, for not relieving it, with a force greatly inferior to that of the enemy.

In general this island is level, having but one hill of any elevation, named mount Toro, nearly in the centre of the island. The climate is less mild and temperate than that of Majorca, wanting the shelter which this latter receives from the mountains of Catalonia, against the violent northerly winds from the Gulf of Lyons, the effects of which are strikingly visible in the naked barrenness of the north coast, whose few trees are stunted and bent to the south. The want of elevations to arrest the clouds renders the summers hot and dry, while the autumns are wet, and the winter raw, though there is seldom snow or ice: the spring is therefore the only agreeable season, being pure and serene. The variations of the thermometer are between 48° and 80°. In general this island presents a base of calcareous rock, covered with a layer of earth and sand, and possessed of different degrees of fertility, according to the depth of this soil, or the preponderance of these substances. The island furnishes limestone, marbles, slate, potter's clay, and talc or muscovy glass. Iron ore is also met with, and it has some poor veins of lead. On the east coast are several lagoons, separated from the sea by narrow strips of land, through which the sea-water filters. They abound with excellent millet. In Levant winds their level is higher than the sea, and with westerly winds lower; the waters of the lake not following with equal celerity the irregular movements of the sea caused by these winds.

The only timber trees are pines and ever-green oaks. The crops of wheat, rye, barley, and Indian corn, taken together, are insufficient for the consumption. The wild quadrupeds are, a very few hares, abundance of rabbits, and some porcupines; the land tortoise is also met with. The domestic animals were, in 1805, 600 horses, asses and mules, 6000 to 7000 horned cattle, 40,000 to 45,000 sheep and goats, and 10,000 hogs. The larger cattle are similar to those of Majorca; the sheep and goats small and lean. The hogs, which are large, are in the autumn turned into the woods to feed on the acorns; and in winter are fed with barley, which renders their flesh excellent: and pork is the chief animal food of the Minorcans as well as Majorcans. The reptiles met with on the island are snakes and lizards; scorpions and centipedes are common. The birds taken for food are the red-legged partridge, quail, wild pigeons, doves, thrushes, woodcocks, snipes, wild duck, and teal.

The population of the island is about 30,000. In 1805 its military establishment consisted of 1500 chasseurs, 3100 infantry of the line, ninety cavalry, and 500 artillery: total 5,190 regulars; of whom 350 form the garrison of Ciudella, fifty of Fornels, and the remainder (with the exception of some small detachments of four to eight men, in the small forts and towers on the coast), are stationed at Port Mahon, where is also a park of field artillery. The governor is usually a brigadier in the armies of Spain. The inhabitants retain the partiality of their ancestors to the use of the sling; but they are a simple inoffensive race, who give themselves very little concern about the rest of the world, provided their course of life is not interrupted. They are not, however, incapable of activity; and, when the island belonged to Great Britain, they carried on a tolerably active shipping trade in the Mediterranean. They are very fond of processions, and of dancing to the sound of their rude musical instruments. Their dress and language are similar to those of Majorca.

The principal capes of the island are, Cape de Sella, the north point. Cape Mola, north of the entrance of Port Mahon, is a lofty peninsular promontory, descending perpendicularly to the sea; on it is a signal tower, and at its foot are three steep rocks. Cape d'Artush, the south-west point of the island, is low, with eighteen to twenty fathoms close to it, and E.S.E. of it a shoal, on which the sea only breaks in bad weather, with a passage within it for small craft only. Cape Bayoli is the west point of the island.

Port Mahon, the principal place of the island, is on the east coast, and one of the best harbours of the Mediterranean, being five miles deep; its greatest breadth one mile, and at its entrance only ninety fathoms. In the port are four islands; the first, called King's or Bloody Island, has on it a large building, erected for the naval hospital by the English in 1773: it was intended to hold 250 patients. On the second island are magazines and lodgings for receiving the cargoes and passengers of vessels arriving from the Levant, with clean bills of health, while performing quarantine. The name of the third, Lazaretto Island, denotes its uses; it is joined to the main land by a narrow neck, covered at high water. Redonda, the fourth island, is a circular mass of rock communicating with the main by a wooden bridge. On it were the English naval magazines and dwellings of the officers of the naval department, surrounded by a wall flanked with square towers; a pier runs out from it, at the extremity of which are masting shears, and alongside of which the largest ships heave down.

Opposite Lazaretto Island, on the south shore of the port, is the village of San Carlos, entirely

inhabited by sea-faring persons; here are also barracks for 4000 men. Midway, between this village and the city of Mahon, was the famous fort St. Philip, or the Ravalle, a league in circuit, which commanded the entrance of the port; but the works of which have been entirely blown up by the Spaniards, so that, at present, the only defences are a battery on the south shore, of twenty-three guns, eighteen and twenty-four pounders; Fort Philipet on the opposite shore, in which are but four or five guns; and a Martello tower, with but a single gun on the same shore. On one of the heights that line the north shore is a tower, which repeats to Mahon the signals from Mount Toro; which latter commands a view of the sea all round the island.

The city of Mahon is on the south shore, near the head of the port; it is built on elevated rocky ground, whence it enjoys the two advantages of a fine view and salubrity. The streets, which in general are narrow and crooked, are paved with large pebbles; the houses tolerably built of stone, with windows and chimney-places in the English manner, and each has a cistern to preserve the rain water. The principal public buildings are the government house, town house, a church, two convents of men, one of women, and a civil hospital. The town was formerly surrounded by a wall, of which the vestiges of one gate alone remain.

Commencing at port Mahon, and tracing the circuit of the island by the north, we meet in succession with the isle Coloms, tolerably high, with only a passage for boats within it. On its west is the road of Sessilanes, fit for vessels of middling size, sheltered from all winds but north-west, which throws in a great sea; but with good cables there is little danger. There is also a road on the south-east of the island, sheltered from all winds but E. N. E. to E. S. E., and a little haven for small craft entirely land-locked.

Port Adaye has depth only for small craft; off it are three islands, one of which is elevated and the two others very low. Port Fornels is an extensive basin, with a narrow entrance; but in which is seventeen to twenty fathoms, and no danger but what is apparent. Its entrance is defended by a little square fort, within which are barracks for 100 men, and by a tower on the opposite shore with an eighteen pounder. At the head of the port the English constructed a wooden fort of two stages, the lower serving for the lodgment of the soldiers, and in the upper one are port holes for four large guns. All these works are neglected by the Spaniards, who have here only fifteen soldiers. On the right shore of the port is a little hamlet of fishermen, its only inhabitants.

The gulf of Anfros is a large bay with high shores and several coves. Port Sanitge, half a mile deep, and one and a half cable's length broad at the entrance, can receive small vessels, which lie sheltered from all winds, opposite a cavern on the west shore. On the north-west of the port is the island Porcos, elevated on the north and very low on the south; the channel within it is only fit for small craft. The rock of Antichrist is a high head-land west of Port Sanitge.

Ciuda-della, or Cittadella, the capital of the island, is on the west end, south of Cape Bayoli; it is surrounded by a wall with bastions, and has barracks for 600 infantry and thirty horse; a cathedral, two parish churches, and four convents; with four cisterns of hewn stone to preserve the rain water. The streets are narrow, crooked, and badly paved. Its port is by no means good; for, though the entrance is narrow, west and south winds make a great swell in it: it terminates in marshy shoals. On the right side of the entrance is a Martello tower with two guns; and near it the church of St. Nicholas, held in great veneration by the Minorcan seamen. On the opposite shore is another tower. Saint Andros Cove, north of Cape d'Artush, is only fit for small craft. Saint Galdan's Cove, two miles east of the same cape, is the best road on the south coast, having shelter from all winds but west in four fathoms.

The Layre de Mahon is a small barren rocky island off the south-east point of Minorca, very low on the north-west, and rises to the south-east, where it terminates perpendicularly; in the channel within it is seven fathoms. A little salt is made on it.

MINOS I., in fabulous history, king of Crete, son of Jupiter and Europa. He flourished about A.A.C. 1432. He gave laws to his subjects, which remained in force in the age of the philosopher Plato, about 1000 years after his death. His justice and moderation procured him the titles of the favorite of the gods, the confident of Jupiter, and the wise legislator, in every city of Greece; and, according to the poets, he was rewarded for his equity after death with the office of supreme judge in the infernal regions. In this character he is represented sitting in the shades and holding a sceptre in his hand. The dead plead their causes before him; and the impartial judge shakes the fatal urn, which is filled with the destinies of mankind. He married Ithona, by whom he had Lycastes, the father of Minos II.

MINOS II., the grand-son of Minos I., and king of Crete, married Pasiphae, the daughter of Apollo and Perseis, by whom he had many children. He increased his dominions by the conquest of the neighbouring islands. He took Megara by the treachery of Scylla; and obliged the Athenians to send annually to Crete seven chosen boys and seven virgins to be devoured by the Minotaur. This bloody tribute was abolished when Theseus destroyed the monster. When Dædalus, whose industry and invention had fabricated the labyrinth, and whose imprudence in assisting Pasiphae in the gratification of her desires had offended Minos, fled with artificial wings from the place of his confinement, and arrived safe in Sicily, Minos pursued him, resolved to punish his infidelity. Cocalus, king of Sicily, who had hospitably received Dædalus, entertained his royal guest with dissembled friendship: and, to preserve an artist whose ingenuity and abilities he so well knew, he put Minos to death, about thirty-five years before the Trojan war. He was father of Androgeus,

Glaucus, Deucalion, Phædra, and Ariadne. Many authors have confounded the two Minoses; but Homer, Plutarch, and Diodorus, prove plainly that they were two different persons.

MI'NOTAUR, *n. s.* Fr. *minotaure*; Lat. *minos* and *taurus*. A monster of the poets, half man and half bull; said to be kept in Dædalus's labyrinth.

> Thou may'st not wander in that labyrinth,
> There *minotaurs*, and ugly treasons lurk.
> *Shakspeare.*

The MINOTAUR, in fabulous history, was the fruit of Pasiphae's amour with a bull. Minos having refused to sacrifice a white bull to Neptune, which he had received from the god for that purpose, Neptune, in revenge, made Pasiphae, the wife of Minos, enamoured of this fine bull. Dædalus prostituted his talents subservient to the queen's unnatural desires; and by his means Pasiphae's passions were gratified, and the Minotaur came into the world. Minos confined in the labyrinth this monster, where he devoured the young men and maidens annually exacted from the Athenians. Theseus delivered his country from this barbarous tribute, when it had fallen to his lot to be devoured; and by means of Ariadne, the daughter of Minos, destroyed the monster, and escaped from the windings of the labyrinth. The fable of the Minotaur has been thus explained:—Pasiphae was enamoured of one of her husband's courtiers called Ταυρος, or Tauros (which in Greek, as well as Latin, signifies a bull); and Dædalus favored the passion of the queen, by allowing his house to become the retreat of the two lovers. Pasiphae brought forth twins, one of whom greatly resembled Minos, and the other Taurus; whence originated the name, and the fable of the Minotaur.

MINSK, or MINSKK, an important province of western European Russia, comprehending the old palatinate of Minsk, and portions of Polotzk, Novogrodek, and Wilna. Extending from the Dwina on the north to Volhynia south. Its area is about 37,000 square miles, containing 950,000 inhabitants. It is divided into ten circles. Minsk is little better than a dead flat, but productive wherever the soil is called into operation by culture; but a great part, particularly of the south, is overrun with marshes and forests. The rivers are numerous, and some of considerable size. The chief are the Dwina, Dnieper, Niemen, and Beresina; the last memorable for the struggle on its banks between the Russians and the French, in the retreat of the latter from Moscow, in 1812. All the productions of Lithuania are found here; but wood and potash are the chief articles of export. The inhabitants are Poles, Lithuanians, Tartars, Armenians, Greeks, Jews, and gypsies. The chief part are Catholics; but there is also a number of Protestants, and members of the Greek church.

MINSK, a town of Russian Lithuania, the capital of the government of this name, is situated on the Swislocz, and has an abbey of the Greek church. Population 2000, chiefly Jews. 310 miles E. N. E. of Warsaw.

MIN'STREL, *n. s.* } Span. *menestrel*; low
MIN'STRELSY. } Lat. *menestralus*. A musician; one who performs instrumental music: minstrelsy, the music or harmony resulting; also a number of musicians, taken collectively.

> I to the vulgar am become a jest;
> Esteemed as a *minstrel* at a feast.
> *Sandys's Paraph.*
>
> Hark how the *minstrels* 'gin to shrill aloud
> Their merry musick that resounds from far,
> The pipe, the tabor, and the trembling croud,
> That well agree withouten breach or jar.
> *Spenser.*
>
> I will give you the *minstrel*.
> —Then I will give you the serving creature.
> *Shakspeare*
>
> Apollo's self will envy at his play,
> And all the world applaud his *minstrelsy*.
> *Davies*
>
> That loving wretch that swears,
> 'Tis not the bodies marry but the minds,
> Which he in her angelick finds,
> Would swear as justly, that he hears,
> In that day's rude hoarse *minstrelsey*, the spheres
> *Donne.*

The Israelitish dames, when they saw their danger, though they might have left their timbrels behind them; yet now they live to renew that forgotten *minstrelsey* and dancing. *Bp. Hall.*

> I began,
> Wrapt in a pleasing fit of melancholy,
> To meditate my rural *minstrelsey*,
> Till fancy had her fill. *Milton.*
>
> These fellows
> Were once the *minstrels* of a country show;
> Followed the prizes through each paltry town,
> By trumpet cheeks and bloated faces known.
> *Dryden.*
>
> Often our seers and poets have confessed,
> That musick's force can tame the furious beast;
> Can make the wolf, or foaming bear restrain
> His rage; the lion drop his crested mane,
> Attentive to the song; the lynx forget
> His wrath to man, and lick the *minstrel's* feet.
> *Prior.*

MINSTREL is by others derived from the French menestrier, and was not used in England before the Norman conquest. They united the powers of melody, poem, and dance. The Saxons, as well as the ancient Danes, had been accustomed to hold men of this profession in the highest reverence. Their skill was considered as something divine, their persons were deemed sacred, their attendance was solicited by kings, and they were every where loaded with honors and rewards. In short, poets and their art were held among them in that rude admiration, which is shown by an ignorant people to such as excel them in intellectual accomplishments. When the Saxons were converted to Christianity, in proportion as letters prevailed among them, this rude admiration began to abate, and poetry was no longer a peculiar profession. The poet and the minstrel became two persons. Poetry was cultivated by men of letters indiscriminately; and many of the most popular rhymes were composed amidst the leisure and retirement of monasteries. But the minstrels continued a distinct order of men, and obtained their livelihood by singing verses to the harp at the houses of the great. There they were still hospitably and respectfully received, and retained many of the honors shown to their predecessors, the bards and scalds. And, indeed, though some of them only recited the compositions of others, many of

them still composed songs themselves; and all of them could probably form a few stanzas on occasion. In the fourth year of Richard II. John of Gaunt erected at Tetbury, in Staffordshire, a court of minstrels, with a full power to receive suit and service from the men of his profession within five neighbouring counties, to enact laws, and determine their controversies; and to apprehend and arrest such of them as should refuse to appear at the said court, annually held on the 16th of August. For this they had a charter, by which they were empowered to appoint a king of the minstrels, with four officers to preside over them. These were every year elected with great ceremony; the whole form of which is described by Dr. Plott; in whose time, however, they seem to have become mere musicians. Even so late as the reign of king Henry VIII. the reciters of verses or moral speeches intruded, without ceremony, into all companies; not only in taverns, but in the houses of the nobility. We find that the minstrels continued down to the reign of queen Elizabeth; in whose time they had lost much of their dignity, and were sinking into neglect. One of them is thus described by a contemporary writer:—'About his neck a red ribband suitable to his girdle. His harp in good grace depending before him. His wrest tyed to a green lace and hanging by: under the gorget of his gown a fair flaggon chain, silver, as a squire minstrel of Middlesex, that travelled the country unto fair and worshipful men's houses. From his chain hung a scutcheon, with metal and color resplendent, upon his breast, of the ancient arms of Islington.' Towards the end of the sixteenth century this class of men had lost all credit, and were sunk so low in the public opinion, that, in the 39th of Elizabeth, a statute was passed by which 'minstrels, wandering abroad,' were included among 'rogues, vagabonds, and sturdy beggars,' and were adjudged to be punished as such. This act seems to have put an end to the profession.

MINT, *n. s.* Sax. minте; Fr. *menthe;* Lat. *mentha,*

Mint (*mentha*); a genus of labiate plants, distinguished, however, by having the corolla divided into four nearly equal lobes. The stamens are four, two of them longer than the others. The species are herbaceous, nearly all perennial, having square stems, which bear opposite and simple leaves; the flowers are small, verticillate, collected into bunches in the axils of the leaves. Sixty species are known, all growing in temperate climates, and most of them European. Two or three species only inhabit the United States. They abound in resinous dots, which contain an essential oil. They have an agreeable odor, and have been celebrated, from remote antiquity, both in mythology and from their useful qualities. They partake, in the highest degree, of the tonic and stimulating properties which are found in all labiate plants. The *Mentha piperita,* or pepper-mint, is the most powerful, and, on this account, is most generally employed in medicine. The *Mentha viridis,* or spear-mint, is milder, more agreeable, and is very commonly employed for culinary purposes.

Mint, *n. s.* & *v. a.*
Mint'age, *n. s.*
Mint'er,
Mint'man,
Mint'master.
Sax. mynetian; Belg. *munten;* Teut. *muntzen,* to coin. A place where money is coined; hence, (meta.) a place productive of inventions or conceits: as a verb, to mint is to coin or invent: mintage, coinage; also duty paid or allowance made for coining: a minter, is a coiner: mintman, one skilled in this art: mintmaster, one who presides over or directs it; also an inventor or discoverer.

A man in all the world's new fashion planted,
That hath a *mint* of phrases in his brain.
Shakspeare.

Sterling ought to be of pure silver called leaf silver, the *minter* must add other weight, if the silver be not pure. *Camden.*

That which is coined, as *mintmasters* confessed, is alloyed with about a twelfth part of copper. *Boyle.*

The great *mintmasters* of these terms, the schoolmen and metaphysicians, have wherewithal to content them. *Locke.*

What is a person's name or face, that receives all his reputation from the *mint,* and would never have been known had there not been medals.
Addison on Medals.

As the *mints* of calumny are at work, a great number of curious inventions are issued out, which grow current among the party. *Addison.*

When Scandal has new *minted* an old lie,
Or taxed invention for a fresh supply,
'Tis called a satire, and the world appears
Gathering round it with erected ears. *Cowper.*

An actor is in the capacity of a steward to every living muse, and of an executor to every departed one; the poet digs up the ore; he sifts it from the dross, refines and purifies it for the *mint:* the actor sets the stamp upon it, and makes it current in the world. *Cumberland.*

Mint. The mint, which now forms so real an ornament to the eastern side of Tower Hill, has derived its name from the important business of coining having been originally conducted within the Tower.

This attribute of sovereign power was exercised by our Anglo-Saxon monarchs. Mr. Turner (History of Anglo-Saxons, vol. II. 134) considers that the use of coined money came in with the Roman ecclesiastical power; but no gold coins of this period of our history have reached us: that metal our historian thinks was only used in an uncoined state. See the article Coins. Mints were established (Wilkins's Leg. Anglo-Saxons) at various considerable places beside the capital; indeed, from Domesday-book, they seem to have been a usual appendage of large towns.

Athelstan, according to Mr. Ruding, first enacted regulations for the government of the mints. In his laws, promulgated about the year 928, he provided that one sort of coin only should be current throughout the kingdom, and granted to certain towns, by name, a number of moneyers, proportionate to their size and consequence, and to all boroughs of inferior rank one moneyer each. These mints were under the general control of that within the tower of London, from which, as paramount, the dies were issued; and for which the moneyers paid a regular fee upon every alteration of the coins.

They also paid an annual rent, which, in the city of Lincoln, amounted to £75 (according to the statement of Doomsday-book), a very considerable sum at that time. The rents of the other mints were, however, much smaller.

As well as these, the author of Annals of the Coinage notices certain early mints not directly subordinate to the crown, and founded either upon usurpation or upon grants of the sovereign to individuals or corporate bodies. Of these several are mentioned as in the hands of the barons in the reign of Stephen. Athelstan confined the ecclesiastical mint to Canterbury, where the archbishop was allowed two moneyers, and the abbot one; and to Rochester, where the bishop was authorised to employ a single moneyer: but in these and all succeeding grants from the crown, while the profits of the coinage effected was assigned to the church, the dignitaries in question were forbid to use any dies but what they received from the tower of London, and for the use of which they were compelled to pay a rent to the master of the mint. In later times, however, certain ecclesiastics were permitted to add distinguishing signs, or mint marks to their money, or, at least, on the smaller coins; for it was one of the articles of impeachment against Wolsey, that he inserted a cardinal's hat on the larger ones.

Connected with the various provincial mints were exchanges, established in certain large towns for the purpose of receiving in the old, and distributing new coins. Here also bullion and plate were purchased in the name of the sovereign; foreign coin exchanged for that of the kingdom, or supplied to travellers and merchants, according to public tables of their value.

The series of coins from the metropolitan and other ecclesiastical mints terminates in the reign of Henry VIII., Cranmer and Lee, the archbishops of Canterbury and York of that period, being the last who exercised this privilege: but it was not until the reign of queen Mary that the subordinate royal mints were finally abolished. The coinage has ever since been exclusively conducted at the tower, with the exception of a short period in the reign of Charles I.; another in that of his son; and during the great recoinage immediately after the Revolution, when mints were once more put in operation in York, Chester, Exeter, Bristol, and Norwich. To these exceptions the annalist finally adds the new 'era' which 'started up' in the late reign, i. e. in the mint for the copper coinage, conducted by Mr. Boulton at Soho.

In 1806, the other uses to which the tower buildings had become devoted having rendered the part appropriated to the mint within the tower very inadequate for the purpose, a portion of what was called the Little Tower Hill (formerly occupied as the government tobacco warehouse) was selected as the site of a new mint. Grants of money were made by parliament from this time to 1810, amounting in the whole to £261,977 for the erection of the present elegant and commodious structure, with its machinery; and in no part of the world besides, we believe, are equally effective and scientific coinage operations now carried on.

The head officer of this establishment is the *master of the mint*, an appointment of sufficient influence and emolument to be considered technically ministerial; and it generally therefore follows the usual changes of administration. To Mr. Wellesley Pole, who held it during the ministry of lord Liverpool, the mint is indebted for its existing and completely renovated constitution, founded on a report of that gentleman to a committee of the privy council; and which took effect in the year 1815. According to this the practical duties of the mint are thus regulated:—

1. The *deputy-master, and worker*, is to receive, on account of the master and worker, his majesty's own bullion of gold and silver, as well as the bullion of any other person, brought to the mint for coinage: to give acknowledgments for the same, specifying the number of ingots, or parcels of coin, according to the purport of any invoice or bill delivered therewith: to see the ingots safely deposited in the care and joint custody of himself and the master's assayer, for the purpose of being assayed previous to their importation into the office of receipt: to cause ingots, when duly assayed, to be brought into the office of receipt without delay, there to be weighed in the presence of the importers and check-officers: to make out a mint bill, to be delivered to the importer, testifying the weight, fineness, and value of the several ingots, &c., together with the day and order of the delivery into the mint, and to sign a receipt annexed to the said bill, witnessed by the comptroller and king's clerk: to give directions to the master's first clerk, for the combining or potting the ingots for the melting, with the proper portion of alloy; and to see that the same be duly entered by the said first clerk and melter, in the pot-book, and the said book examined by the comptroller and king's clerk; and to deliver out of the strong hold such ingots and bullion as are potted, and charge the melter therewith, according to the standard weight of each pot: to keep an account of the bars received from the melting-house, and delivered to the moneyers, and also of the scissell returned by the moneyers to the melter, for which their respective receipts will be given and entered in the pot-book, that they may be charged therewith: to receive the coined monies from the moneyers, after the same have been duly tried at the pix by the king's assayer, comptroller, and king's clerk; and to deliver the same to the importer, receiving back at the same time the mint bill which had been given; or, if the same be not cleared off, to require that such portion thereof as has been delivered, be indorsed on the bill by the parties, by a receipt, till the whole be discharged: to seal and lock up in the usual chest, in conjunction with the king's assayer and comptroller, the pieces reserved for the public trial of the pix, and to make good to the parties the pieces so taken, by payment in their sterling value; charging the same to the public expense.

As first executive officer of the mint, to watch over every branch of the department, and to inspect and oversee, as much as lies in his power, the meltings, assayings, and all the different processes of the coinage, and to report to the master

on the conduct of the officers: to draw and indite all letters, instructions, commissions, and other writings agreed upon and ordered by the master and worker, for the service of the office, and to have the same recorded by the clerk of the papers: to receive all monies issued at the exchequer or elsewhere, for the service of the mint; and to keep the public account of the master, to be laid annually before the auditors of public accounts, with the proper vouchers, the said account to be signed and attested by the master himself: to make quarter books of the salaries, wages, allowances, &c., due to the several officers, clerks, artificers, and others belonging to the establishment; and to make payment thereof on the quarter days, namely the 5th of January, the 5th of April, the 5th of July, and 10th of October, whenever there shall be funds for that purpose: also, to pay the moneyers' and melters' charges for coinage, according to the rates set forth in their respective agreements with the master; the same to be payable out of the monies issued for the service of the mint, the salaries &c., being previously discharged: also, to pay the incidental expenses and disbursements usually incurred in the different offices; and to pay the solicitor his account for disbursements in carrying on prosecutions for offences against the laws relating to the coin, out of such monies as shall be impressed from time to time, for that service, exclusive of the ordinary allowance: to receive all the fees arising to the master's office under the indenture or otherwise, and to apply the said fees to the payment of the master's salary, in the manner directed by the act 39th Geo. III., and to account for the same to the lords commissioners of his majesty's treasury, by half yearly statements, showing the deficiency of the fees, and the sum to be provided, or the excess, as may happen; and to make out a yearly account to the treasury.

For this office he is to give the usual security, or such other as may be required by the lords of the treasury: in conjunction with the comptroller, to inspect and examine the accounts of the clerk of the irons, as to the dies supplied to the engraver and moneyers, and the faulty ones destroyed; to attend the duties prescribed by the act 14th Geo. III. respecting the standard money weights.

2. The *king's assayer* is to keep a book of the assays made by him, of all such gold and silver as may be brought into the mint, whereby the quantity and fineness may appear. If the master of the mint, or the merchant, or importer, who brings his gold or silver for coinage, may not accord between them of the true value of the bullion, or if it be not malleable and fit for working, or sufficiently nigh to the standard, according to the customs of the mint, the king's assayer is to try the truth in that part, in the presence of the master and comptroller, and the master shall receive the same in manner as it becometh: to report (after the bullion has been weighed, potted, and melted) the assay of every several pot, commonly called the pot assay, which pot assay shall be made of some bar of the said bullion, to be taken by the comptroller, the king's assayer, or surveyor of meltings, or any one of them, after the pot is cast out; the said report to be made in writing, and delivered through the office to the surveyor of melting: to take care that the bars of gold and silver be melted, and the monies made agreeably in fineness to the indented trial plates, made by direction, and ordered to be used by the royal authority; whereof one trial plate for the gold, and one for the silver, shall remain with the king's assayer.

In conjunction with the other principal officers to oversee and survey the assaying, and melting, and making the monies, at all times and in all places: and endeavour and procure that the said monies, and every of them, shall be properly made and perfected: to see and procure, with the comptroller, and weigher, and teller, that the balances and weights be put to point from time to time, when they shall need it; so that no default be found in them, to the hurt of his majesty and his people: to make proof (by a process called the pixing) of the monies before their deliverance to the bringers in of the bullion; the said proof to be made in the presence of the master and worker, comptroller, and king's clerk, by an assay to be taken of the fineness as well as of the weight, by such quantity, and after such sort as shall be agreed on or as has been customary, namely, by weighing the pound weight in tale; and taking one piece out of every journey weight of gold and silver respectively for the assay of the fineness, as directed by the mint regulations. To report thereon, and the report to be entered in the pix books: in conjunction with the master, and worker, and comptroller, to see a portion, namely, one piece out of every journey weight of the said monies (after they have been proved to be good), ensealed in a packet, and put into a box (called the pix-box), to be locked up under the separate keys of the said officers, there to remain until trial thereof by jury (called the trial of the pix) shall be made before the king, or such of his council as are usually appointed at Westminster, or elsewhere for that purpose.

He shall be bound to instruct in the art of assaying, the probationer assayer, who shall be nominated by the king's assayer, and approved by the master and worker: to attend the duties prescribed by act 14th Geo. III. respecting the standard money-weights.

3. The *comptroller* is to enter on record, in a journal or ledger, all such bullion of gold and silver as shall, from time to time, be brought into the mint, which entry shall comprehend the weight as declared by the weigher and teller; the fineness as reported by the master's assayer; and the value of the said bullion, the parties' names that brought it, and what day: to deposit at the office of receipt in the strong-hold, of which he shall possess a key (in conjunction with the deputy-master and worker, and king's clerk), the bullion, after it shall have been received, and the assays and weight thereof made, reported, and entered, there to remain until it is required to be delivered by the deputy-master for the meltings: in conjunction with the king's clerk, to take an account of the ingots delivered by the deputy-master out of the strong-hold for the meltings, according to the entry made by the master's first clerk and melter in the pot-book

and to examine the said book as to the calculations of the quantities and fineness, of all manner of gold and silver and alloy, combined and put to each pot respectively for the meltings, and to subscribe the same with his initials: to take also an account and oversee the weighings of the bars and scissel, passed through the office between the melter and moneyers; for which their respective receipts shall be entered in the pot-book: to keep an account of all the deliveries of the monies; and to ascertain, at the end of every month or oftener, the balances due by the master to the several importers, and also the balances in the hands of the moneyers and melter, and agree the same with the deputy master, who is to charge the said moneyers and melter therewith accordingly: in conjunction with the other principal officers, to oversee the melting, rolling, sizing, and making, the monies, at all times and in all places; and endeavour and procure that the said monies and every of them shall be made and perfected: to see and procure, with the king's assayer, and weigher, and teller, that the balances and weights shall be put to point from time to time when they shall need it so that no default be found to the hurt of his majesty or his people.

To attend the proof and trial (called pixing) of the monies before their deliverance to the importer, and to try the weight of some of the pieces in each journey weight singly, as a check that there may be no great variation from the true weight; and also to retain two pieces from each journey weight, one to be delivered to the king's assayer for his assay, and the other to be locked in the pix-box, to be tried before the king or his council;—to docquet the parcel containing the pieces for the pix, and with the other officers enseal the same, and lock it in the pix-box: to deliver upon oath, before one of the barons of exchequer, a roll, which shall be called a comptroller's roll, containing an account of all the gold and silver monies coined monthly in the said mint: in conjunction with the deputy-master to inspect and examine the accounts of the clerk of the irons, as to the dies supplied to the engraver and moneyers, and that the faulty ones be destroyed: to attend the duties prescribed by act 14th Geo. III. respecting the standard money-weights.

4. The *superintendent of machinery and clerk of the irons* is to inspect, from time to time, the several steam-engines and boilers, and the machinery, apparatus, and implements, used in the coinage, and to see that the same are kept in proper order for immediate working at all times: to oversee and direct, in conjunction with the company of moneyers, the artificers and workmen employed by government about the machinery in doing all manner of work that may be expedient, and likewise in the construction of all the smaller implements and tools necessary to carry on the coinage, upon the principle of the machinery erected; the repairs and work being ordered under the authority of the master and board of mint officers: to superintend the working of the machinery, and instruct (to the best of his ability) the officers and moneyers in the use and management of it; and to report to the board upon any neglect or misuse: to examine the several accounts of expenses incurred in the machinery,—certifying, in pursuance of the agreements entered into between the master and the moneyers, the charges, both in respect to the bills, and also the wages to the artificers, which shall respectively be borne both by the government and the moneyers.

As *clerk of the irons*, to superintend the die press-rooms; and purchase, or procure to be forged, at the cheapest rate, to be approved by the board, all such dies as shall be ordered by the board, and to take care that the same are of the best quality and properly forged: to oversee the workmen in the die-press room, and that the dies be skilfully sunk and hardened, and properly turned; and to attend to all matters and things for the well ordering and conducting this service: to keep a true account of all the blank dies, matrices, and puncheons for coinage, which shall be delivered to the engravers, or that shall be sunk or stamped by the engravers, and after stamping made fit for use and hardened: to require the engravers, monthly, to return as many dies as shall be found faulty and worn: to give an account, as often as required, to the master and comptroller, of the blank dies delivered to the engravers, and the faulty ones returned, that a just account may be kept, and all the faulty dies defaced: to unlock and be present whenever the great die-press for multiplying the dies is used; to be responsible for its not being applied for improper purposes; and that no medals, pattern-pieces, or coin of any description be struck, but by a written order from the master or his deputy.

5. The *king's clerk, and clerk of the papers*, is to attend the weighings in, and enter in his ledger-book an account of all such bullion of gold and silver, as shall be brought into the mint, describing the weight and fineness as reported, the parties names that brought it, and the day: to deposit at the office of receipt in the strong-hold, of which he shall possess a key in conjunction with the deputy-master and comptroller, the bullion, after it shall have been weighed in, and the weight and assays reported; there to remain until it shall be required to be delivered over by the deputy-master for the meltings.

In conjunction with the comptroller, to take an account of the ingots delivered by the deputy-master to the melter, as set down in the pot-book, and to examine the calculations of the pot-book as to the quantities and fineness of all manner of gold, and silver, and alloy, put to each pot, and to subscribe the same with his initials: also to take an account and oversee the weighing of the bars and scissel passed through the office between the melter and moneyers, for which their respective receipts shall be entered in the pot-book: to attend the pix and deliverance of the monies, and record the same, and agree the master's, melter's, and moneyer's balances, up to the end of every month: to enter (as clerk of the papers) in the record-book, all office-letters, papers, appointments, warrants, and proceedings of the board: to assist the deputy-master in the secretary department, and instruct the master's

second clerk in the keeping the proper entries of bills and accounts for expenses incurred, or in making copies of all such papers as shall be required by the master or his deputy, or by the board.

6. The *master's assayer* is to receive from the master and worker all manner of gold and silver ingots brought to the mint: to deposit the same in the joint custody of the deputy-master and himself, in the strong-hold of the assay office, till the assays are made: to cut one or more pieces from each ingot (as he may think proper), and assay the same: to make written reports of the assay of each ingot, describing the fineness, date, and name or mark of the importer, and keep a record thereof. To make also such remarks on the quality of the bullion as may be needful for the master's information, and to deliver the list usually given by the importer of the purchase assays: to give instructions for the classing of certain of the ingots together, so that the bullion may be mixed and worked as close to the standard as possible, and advantages procured by the mint assay: to deliver the ingot when assayed into the office of receipt.

7. The *master's first clerk and melter* is to superintend and carry on the operations of the meltings and refinings, according to agreements (stating the prices and conditions) to be made from time to time between the master and melter: to attend the weighings in at the office, and rate and standard the ingots in conjunction with the other officers; and their several accounts agreeing to enter the same in his journal; so that no difference may arise between the deputy-master and himself as to the value of the bullion to be delivered to melt: to arrange under the direction of the deputy-master from the said journal, and from the list of ingots classed by the master's assayer, the combination of the bullion for melting, and to make the proper calculations of the quantities and fineness of all manner of gold and silver and alloy put to each respective pot, and to enter the same fairly in a book (called the pot-book), and subscribe his initials to each pot so made up: to receive the bullion so prepared from the deputy-master, to be deposited and melted under the joint custody and inspection of himself and the surveyor of meltings: to melt and cast the bars (according to agreement); and, after they have been assayed and reported standard by the king's assayer, to deliver them into the office of receipt; there to be weighed by the weigher and teller, in presence of a check officer, and passed to the moneyers: to receive the returns of scissel, light work, and ends (according to agreement), from the moneyers, to be weighed in like manner, the receipts between the moneyers and melter for the bar and scissel being entered in the pot-book: to receive from the deputy-master all such gold and silver as may be necessary to refine; to make up an account in the pot-book of each charge, showing the standard amount, to be signed with his initials, and examined by the comptroller and king's clerk; and to supply a quantity of fine ingots, equal in standard weight by computation to the amount delivered to refine, the same to be assayed by the master's assayer, and weighed into the office of receipt, and rated and standarded so as to combine and pot with the coarse ingots: to agree the balances remaining in his hands with the deputy-master at the end of each month: to employ and instruct the master's second clerk in the art of melting bullion; and, lastly, to be ready to do his work at all times, when he shall be warned by the master and worker; and to attend to his majesty's service as need shall require, both morning and afternoon, and to work so many hours every day (Sundays excepted) at such tasks as shall be thought fit by the master, and appointed by the board.

8. The *provost and company of moneyers* are to superintend and carry on jointly as a company, the several processes for the manufacture of the coin, in the rolling, annealing, blanching, cutting out, sizing, and stamping, according to agreements (specifying the prices and conditions) to be made from time to time, between the master and worker, and the provost and company: to receive the standard bars of gold and silver for making the monies, from the melter at the office of receipt, there to be weighed by the weigher and teller, in the presence of a check officer, and to give receipts for the same to be entered in the pot-book: to coin such quantities of the different species of the monies as shall be directed by the master (according to agreement), and to bring the said monies (in clean pieces) into the office of receipt, in journey weights; there to be tried at the pix and weighed: to deliver the monies proportionally in weight, according to the bars received; and, if any thing lack of the weight at the time of deliverance, to content and pay unto the master the balance at the time of the delivery: to make out of the bars which shall be delivered to them clean and fit to be wrought, seven-twelfth parts into money, so that there be but five parts in twelve scissel: to return the scissel, light work, and ends to be remelted, proportionally (according to agreement); the same to be delivered into the office of receipt, to be weighed by the weigher and teller, in the presence of a check officer, and to take receipts from the melter to be entered in the pot-book: to agree with the deputy-master the balance remaining in their hands at the end of each month, that they may be charged therewith; and from time to time (as the master shall require) make full payment and deliverance of all manner of monies, with all convenient speed, in order to discharge the said balances, or bring in sufficient supplies of gold and silver, bullion, or ingots, equal in value, according to the weight and assay to be made thereof at the time: not to take either singly by the provost, or jointly by the company, any apprentice to be instructed in the art or mystery of a moneyer, or any part thereof, without the license and permission of the master first had and obtained under his hand in writing.

To oversee, in conjunction with the superintendent of machinery, who is to direct the same, the artificers enployed by government about the machinery, in doing all manner of work that may be expedient, and in the construction of the smaller tools and implements for the coinage.

to be ready to do their work at all times without denial, when they shall be warned by the master: duly to attend his majesty's service, in the present way of coining, as need shall require, both morning and afternoon; and to work at such tasks, and so many hours every day (Sunday only excepted), as shall be thought fit by the master, and appointed by the board, according to the labor of their respective tasks, and the length of days: neither the provost, nor any of the moneyers, their apprentices or servants, at any time, to vend, pay, or distribute any piece or pieces of the coined monies, until the same shall have been delivered by them, according to the course of the mint, into the office of receipt, and duly assayed and pixed.

9. The *chief engraver* is to make and frame such draughts and embossments, or receive such models for engraving, as the master shall direct: to engrave from the said designs or models all such matrices and dies as the master shall direct, and the service of the mint require: to oversee from time to time the multiplication of the puncheons and dies, in the die press-room, and to receive the dies from the superintendent and clerk of the irons, that they may be delivered to the surveyor of the money presses in a proper state for the use of the coinage: to return monthly to the superintendent and clerk of the irons as many dies as shall from time to time be found faulty, and worn by using or otherwise.

Not to work, or make, or grave any puncheons, matrices, dies, or stamps, for the making or coining of any money, but only in such places in the mint as shall have been assigned thereunto: to oversee the striking of the monies in the coining press-room, and to direct all such dies as are faulty to be taken out of the press, and fresh dies put in, that the monies may be properly struck.

10. The *weigher and teller* is to weigh at the office of receipt, under the master's direction, all manner of bullion brought to the mint to be coined, or for the service of the king: to weigh the bullion, according to such weight or draught (near to a journey weight) as has been customary: all importations to be weighed in the presence of the deputy-master, or master's clerk, comptroller, or king's clerk, and the importer, who is to state the weight of each ingot from his list, for the guidance of the weigher: to declare the weight aloud from his scale, that the same may be taken down by the officers and importers: in conjunction with the other officers, to see that the bullion is free from dirt, and in a fit state for weighing, and to do strict justice, as much as in him lies, between the parties.

To weigh the bars and scissel, passed between the moneyers and melters, and declare the weight of each draught; and also all supplies of fine ingots received from the melter; and the balance or supplies of ingots, &c., made from time to time by the moneyers and melter: to weigh the coined monies from the moneyers to be delivered to the importers in even journey weights, or to declare the plus or minus on each draught, that the same may be recorded, and the moneyers made answerable for the deficiency of weight or balance at the time of deliverance: to attend the pix, and tell out the number of pieces contained in a pound weight Troy of the respective species of monies to be delivered to the king's assayer for trial: to undertake by himself, or by a proper workman in the mint (according to an agreement of prices and conditions), to clean and adjust the beams, &c., in the office of receipt, and to keep the same in order, so that they be always ready and perfect for working.

11. The *surveyor of meltings* is to survey the meltings of all gold and silver, and to take care that the ingots or bullion, according to the number and description in the pot-book, with their proper alloy only, to be weighed by himself, be put into the pot they are respectively set out for: to see that nothing but scissel or such returns or ends as be clean and good, of gold and silver, respectively, be put into the pots of scissell: during the time the pots are melting not to absent himself, or to be out of view of the pots so melting, until they have been poured off: to take two or more assay pieces from some bar or portion of each pot cast from the top, middle, or bottom, of the pot, as agreed with the king's assayer: to fold up each assay-piece in a paper, docqueted with a description of the ingots and alloy, or scissel, &c., melted in each pot, the number of the pot and the date, and to deliver the same to the king's assayer: to possess a key of the strong-holds in the melting house, and not to suffer any bars of gold or silver to be delivered out of his custody, until such time as they have been duly assayed and reported good, which reports will be made to him in written notices, transmitted through the office by the king's assayer: to keep a book containing the weight of all gold and silver as shall be molten from time to time, with the alloys put into the same.

12. The *surveyor of the money presses* is to inspect the coining presses, and to have a distinct and separate lock upon each of the presses: to be present at the striking of the monies, and not to suffer the presses to be used for striking any pieces or coins but such as the master shall direct: to have the custody of the dies received from the engraver and clerk of the irons, to give out the same for coinage, and return the faulty ones to the chief engraver, to be delivered to the clerk of the irons: to polish the dies, or oversee the doing of the same, when the moneyers are coining: to inspect the monies, that they be well made and free from brokages, and faulty or dirty pieces; and to do, execute, and perform, all such other works and services in the said office as the master shall direct and appoint.

13. The *probationer assayer* is to receive instructions from the king's assayer for acquiring a knowledge and proficiency in the art of assaying: to do all such services, in carrying on the business of the assay-office, as the king's assayer shall require and the master direct.

14. The *master's second clerk* is to make out fair copies and entries of all such accounts and papers as might be required in the master's office, and to do all such services in the said office as the master or deputy-master shall direct or appoint: to receive instructions from the

master's first clerk and melter in the art and undertaking of the meltings.

15. The *assistant engraver* is to assist the chief engraver in the engraving of the reverses, lettering, or such other parts of the dies as the chief engraver shall appoint: to receive instruction from the chief engraver in the art of engraving, and to render all such services in the department as the chief engraver shall require, and the master direct.

16. The *mint or bullion porter* is to attend the office daily, if required: to be present at all importations and deliveries at the office: to mark on the assay paper the weight of each ingot weighed at the scale: to arrange, with the assistance of the master's porter, the ingots in the strong-hold, and put them together in pots, to be carried down to the melting-house: to oversee the under porters in giving all proper assistance at all the weighings, and in the receipt into the mint of all bullion, and deliverance of monies or bullion: to give the regular notices for the attendance of the officers, and other persons at the office, for business, and to do all such services as shall be directed by the master or board.

17. The *warden of the mint* is in conjunction with the master and comptroller, and with the assistance of the king's assayer, to make the weights of a guinea and of a shilling, according to the establisned standards, and also parts and multiples of the same, to be presented to council, and, if approved, to become standard weights, to be lodged in the mint: to have the custody of the said weights at the mint, in conjunction with the master and comptroller: to make also, in conjunction with the master and comptroller, and with the assistance of the king's assayer, copies or duplicates of the said weights, to be lodged with an officer called the stamper of money weights: to summons once, or oftener, in every year, by warrant under the hands of himself, the master and comptroller; the stamper of money weights to appear before them, and produce the said duplicates of the standard weights, to be examined and compared with the standard weights lodged at the mint office in their custody: to pay the salary allowed to the stamper of money weights out of monies to be entrusted to him for that service by the master of the mint.

No person to be appointed to act as deputy to the warden, without the sanction of the lords of the treasury.

18. The *stamper of money weights* is to attend the summons of the warden, master, and comptroller, and to have the duplicate weights in his possession compared with the standard weights at the office, at least once a year: to adjust the duplicate weights by the said standard weights, that all weights for weighing gold and silver money may be regulated by the said duplicates: to stamp the weights made use of in weighing the money, receiving a fee of one penny on every twelve weights stamped or marked pursuant to act of parliament: no other weights but those stamped by the stamper of weights, to be accepted by law, for determining the weight of the coins; and persons counterfeiting the stamps, or altering weights so stamped, to be fined and imprisoned: not to interfere with the weights of the founders' company, if they have their weights sized and marked as above: to receive the salary allowed to his office from the warden or his deputy.

19. The *solicitor of the mint* is to attend the board of mint officers every Wednesday, or such other day as may be appointed, to lay before them such information and depositions, in regard to persons offending against the laws relating to coin, and to receive the board's orders for acting thereupon: to act in conformity to such order, in the prosecution of all such persons as shall clip, counterfeit, melt down, wash, file, or diminish the current coin of the kingdom, or alter any counterfeit coin, knowing the same to be counterfeit, or be guilty of any crime or offence concerning the said coin or money, or against the laws relating to them.

For the better carrying on of the prosecutions that may happen, at the same time, in different counties, to substitute and employ such other person as he shall see fit in his stead: to make out quarterly accounts of the expenses of the prosecutions, with the proper vouchers, to be examined by the board of mint officers, showing the disbursements made by him; and to make an abstract account at the end of every year, of monies received and expended, that the balance may be ascertained and the account discharged.

20. *The general instructions for the common duties of the principal officers*, i. e. *the deputy-master and worker, king's assayer, comptroller, superintendant of the machinery, and king's clerk.*

i. To make their ordinary habitations and abode in houses assigned them within the mint: to meet in the board-room at the mint office every Wednesday (after the delivery of the monies), or on such other day and hour as the master or the service of the mint shall require, there to form a board. Three members (the master or his deputy being one) are competent to act.

ii. To consult together, and order all business appertaining to them concerning the office, determining the hours of attendance of the several officers, the receipts of the bullion, and the delivery of coin: to consider and give directions to the solicitor of the mint, from information laid by him before the board, for undertaking prosecutions for offences relating to the coin, and require him to report, from time to time, as to the state of the prosecutions and convictions.

iii. To take up and employ such smiths, workmen, and laborers, as may be severally wanted in the die department and assay offices; and for assisting in the porterage and weighing of the bullion and coin in the office of receipt, and to order the superintendant of machinery, and clerk of the irons, to purchase or procure to be forged all such dies as are necessary for the coinage or service of the mint, and to provide all necessaries, and do all manner of business within the mint as may be needful.

iv. To observe, follow, and perform, all orders, warrants, or significations of the master and worker, whether grounded upon warrants from the king, the lords of the committee of council

for coin, or the lords commissioners of the treasury; and in all things to obey jointly or severally, in their respective places, such directions as he shall from time to time judge necessary and fit to give for the service of the mint.

v. To see that the accounts of the office for the receipt of the bullion and delivery of the coin, as well as the check and control thereof, be kept in due manner as prescribed, and that the comptrolment roll of the monies coined monthly, be exhibited yearly to the auditors of public accounts.

vi. To see also that the receipts and payments of all monies, for the service of the mint, be charged and accounted for in the master's public account, and that all bills, accounts, and statements, belonging thereto, be examined and allowed under at least three signatures of the principal officers, of which the master's deputy is to be one, previously to its being laid before the audit office: also to examine and report to the lords commissioners of the treasury on the fees derived to the master's office; and the application thereof, pursuant to the act 39 Geo. III., as stated in the receiver's account; in order that the same may be declared and passed.

vii. To prescribe to the under officers and servants, their several charges and duties, and to see the due performance of them; and, in case of negligence or unfaithful conduct, to report to the master, or, as far as the board are authorised, remove them from their situations: not to suffer the works of the mint to be viewed without an order signed by the master; or any stranger or foreigner, not having business at the mint, without any knowledge of his quality, to have intercourse with the officers while performing their duties.

The foregoing official rules will give the reader a general impression of the business conducted at this establishment: we shall now endeavour to conduct him through the several *offices* as they are ordinarily engaged in performing it.

From the bank of England almost all the coined money of the kingdom is first received in the shape of bullion; which is sent to the 'master of the mint's assay office', and received into what is called the *strong-hold*, where it is kept until its fineness is ascertained, in order that its value may be computed.

This being ascertained, the parties concerned are desired to attend at the office of *receipt and delivery* to witness its weight, and to be informed of its fineness, and, consequently, of its value; the standard weight of the bullion being determined by the calculation of the respective offices: a mint-bill is now handed to the owner or owners of the bullion, on which the exact value of that deposit is recorded.

The next thing is to deliver the bullion to the *melting-house*, which is furnished with a variety of apparatus, adapted, not only to the melting of the gold and silver, but the lifting in and out the pots containing the precious metals, with safety, ease, and expedition. The silver is melted in pots of cast-iron, but the gold is melted in smaller pots manufactured from black-lead, which, according to the modern chemistry, is a carburet of iron. The silver is run into plates ten inches long, seven wide, and about five-eighths of an inch thick: the gold-plates are ten inches in length, four in breadth, and three-eighths of an inch in thickness. While the metal is pouring into the moulds, there are three portions taken, from the top, the middle, and bottom of each pot, and carried to the king's assay-office, there to be examined by the master of that office, and not permitted to pass into work until the fineness of the metal is accurately determined. The furnaces used are air-furnaces, and the fuel is coke. In the process of melting, as there will necessarily be waste, every thing that can possibly contain any portion of the precious metals, such as the sweepings of the melting-house, &c., are collected and carried to another apartment, in which are erected two grinding and two triturating mills, where the sweep is worked up, and the fine metals in part recovered, in the manner practised by refiners and goldsmiths.

The *sweep*, thus brought together, is ground into a powder, and passed through a fine sieve, by which the larger grains of metal are obtained. The sweep is then put, in small portions, into a wooden bowl, having two iron handles, by which it is carefully washed: the lighter particles, being absorbed by the water, are collected in a large tub; the heavy or metallic ones are found deposited at the bottom of the bowl. By these means the most considerable of the particles of gold and silver are obtained. The powdered sweepings, however, which have been collected after the washing process, still contain portions of metal; to obtain these, the sweep, in certain portions, is put into a mill, containing generally about 100 cwt of mercury, the remainder of the mill being filled with water: this is commonly called the triturating mill, and each charge is agitated about four hours with an instrument, having four arms placed horizontally, in the shape of a cross, and fixed to the centre of the mill; and, for the better agitation of the sweep and mercury, the motion of this mill can be reversed at pleasure.

From the melting-house, the plates, provided they are found by the assay-master to be of the exact degree of fineness, are carried to the *rolling-mill*. They are first hot-rolled, that is, made red-hot, in a furnace adapted to the purpose, and then passed through a pair of cast-iron rollers. In the room in which this operation is performed there are four pairs of rollers, which (as they require an immense power) are put in motion by a steam-engine, of a power equal to that of thirty horses. The rollers are placed very near the furnaces, and the metal, being brought to what is called a blood-red heat, is taken out by a man with a pair of smith's tongs, and immediately returned by another man, and again passed through while hot two or three times, by which it is greatly extended; after this. it is annealed. This is called the breaking-down rolling, and when finished the plates of silver are about three-sixteenths of an inch thick. They are then cut into slips by a pair of circular shears attached to the shafts, by which the rollers are worked, after which they are finished in what

are called the adjusting-rollers, which are also made of cast-iron, and very finely polished. In this process the slips are rolled cold, and, when a piece cut from the middle of each is found of the proper standard weight, they are carried to another apartment, called the cutting-out room, containing twelve machines worked by a steam-engine of the power of sixteen horses. With these machines the blank pieces are cut out from the strips or laminæ just mentioned with great ease and velocity. The only manual labor required, is that performed by a boy nine or ten years old at each machine; he quickly learns the art of presenting the laminæ to the cutters, which instantly cut out the blank pieces of metal; these so struck fall through a hole that conducts to a box placed below to receive them. Each machine will cut sixty pieces in a minute, of course the twelve will produce 720 in a minute, or 43,200 in an hour. Formerly these machines were worked by hand by a man or boy at each cutter, but no manual labor can operate so accurately and well as the power obtained by the steam-engine. The instruments with which the blanks are cut (called a bed and punch), are made of steel, of the exact diameter of the piece of money required.

The blanks are now carried to the *adjusting-room*, where every piece is most accurately weighed, the gold twice, at least, and the silver once; those pieces that are found too heavy are reduced by the file, called a float, and those that are found too light, which occasionally occurs, are re-melted.

The blanks, properly adjusted, are then conveyed to the *milling-room*. Into this no stranger is allowed to enter; the process of milling being a secret by the very constitution of the mint: and this has always been the case since the time of Peter Blondeau, who introduced the milling in 1662, as appears from Folkes's 'tables of English silver coins.' The blanks, when milled, are annealed, or softened, in order that they may be fitted to receive the impression.

The next operations are *pickling and cleaning*. The process of pickling is to throw the pieces of gold, thus annealed, into a strong solution of super-sulphate of alumine; those of silver into a solution of the super-sulphate of potash. The drying and cleaning is performed by agitation in sieves, containing saw-dust, over a gentle heat.

The pieces are now taken to what is properly called the *coining-room*. In this apartment there are eight coining-presses worked by a ten horse power steam-engine; the apartment also is, in the winter months, heated with steam, so as to be kept to a uniform temperature. The machines are worked with the most perfect accuracy, and with such rapidity that each will produce about sixty in a minute; and on the average, allowing for the necessary delays in working forty pieces of money, that is 320 guineas, &c., will pass through the eight machines in a minute, or about 19,200 in an hour. These machines require also one boy of ten or twelve years of age to each, who, by supplying the machine with the planchets, runs no risque of injury to his fingers, as the machine contains in itself a self-feeder or layer-on; the business of the boy being only to fill the layer-on, through a tube, with the blanks. From this tube, the machine places the blanks upon the dye, and when struck displaces one piece and replaces another, and so on as long as the steam-engine is kept at work. The coin thus completed is carried to the mint-office, where the king's assayer attends, and where the process called Pixing (which see), takes place, to ascertain the weight and fineness of the monies before delivery. Both faces of the coin are struck at once, the upper and under dye being both engraved for the purpose. The dyes are the workmanship of some capital engraver; he, of course, makes the pattern upon soft steel: from this, many others are taken at an office in the mint, and hardened. The engraver is called upon to verify the accuracy of the dies made use of, with the pattern or mould which he has furnished. See Money, and Monetary Art.

MINTO (Walter), LL. D., professor of mathematics in the college of New Jersey, was born at Minto in Roxburghshire, about 1755. His father gave him a liberal education, and, having removed with his family to Edinburgh, young Walter passed through the usual course of education, with the intention of studying divinity. His education was newly completed when he received an offer of a very lucrative situation from an uncle, who having made money in Jamaica, and purchased a plantation, wished his nephew to come and superintend it as overseer. But he yielded this appointment to his younger brother rather than have any connexion with the slave trade. Meantime, while he was waiting for an opportunity of a vacancy among the churches of the Associate Synod, an offer of an appointment was made to him by David Hume, to accompany two sons of governor Johnstone as a tutor, in their travels on the continent. This proposal was readily accepted, and in consequence of it he spent several years abroad, particularly at Pisa in Italy, and became acquainted with a number of the Italian literati, particularly with the celebrated Dr. Joseph Slop, of Cadenberg, professor of astronomy in the university of Pisa, and member of the academy of Bononia. He returned to Edinburgh in 1783; obtained the degree of LL. D. from the university of Aberdeen; went to America in 1784, by the advice of the earl of Buchan; and not long after obtained the professorship of mathematics and natural philosophy in the college of New Jersey; where he taught those useful branches of science, till the 21st of October, 1796, when he died at Princeton, leaving a widow. He published several treatises; particularly, 1. Researches into some parts of the Theory of th Planets, 8vo. London, 1783. 2. An Inaugural Oration on the Progress and Importance of the Mathematical Sciences, 8vo., Trenton, 1788. He also wrote, in conjunction with the earl of Buchan, 3. An Account of the Life, Writings, and Inventions of John Napier of Merchiston, 4to. Perth; wherein the origin of geometry, arithmetic, &c., is treated at considerable length.

MINTURNÆ, a town of Campania, between Sinuessa and Formiæ. In the marshes near it Marius concealed himself in the mud to avoid

the partizans of Sylla. The people condemned him to death; but when his voice alone had terrified the executioner, they favored his escape. See MARIUS.

MINUET', *n. s.* Fr. *minuet;* Ital. *minuto;* perhaps of Lat. *minute,* nice, skilful. A stately regular dance.

The tender creature could not see his fate,
With whom she danced a *minuet* so late.
Spenser.

John has assurance to set up for a *minuet* dancer.
Spectator.

MIN'UM, *n. s.* Lat. *minus.* A small sort of printing letter; also a note of slow time, two of which make a semibrief, as two crotchets make a minum.

He's the courageous captain of compliments; he fights as you sing pricksongs, keeps time, distance, and proportion: rests his *minum,* one, two, and the third in your bosom. *Shakspeare.*

MINUTE', *adj.* & *v. a.* } Lat. *minutus.* Small,
MIN'UTE-BOOK, } slender in bulk or
MINUTE'LY, *adj.* } appearance; incon-
MINUTE'NESS, *n. s.* } siderable: to minute
is to make small or short hints or memoranda: a minute-book, the book used for such purpose: minutely and minuteness, exactly or nicely; smallness; inconsiderableness.

Some *minute* philosophers pretend,
That with our days our pains and pleasures end.
Denham.

In this posture of mind it was impossible for him to keep that slow pace, and observe *minutely* that order of ranging all he said, from which results an obvious perspicuity. *Locke.*

I no sooner heard this critick talk of my works, but I *minuted* what he had said, and resolved to enlarge the plan of my speculations. *Spectator.*

Such an universal superintendency has the eye and hand of providence over all, even the most *minute* and inconsiderable things. *South's Sermons.*

Into small parts the wondrous stone divide,
Ten thousand of *minutest* size express
The same propension which the large possess.
Blackmore.

The serum is attenuated by circulation, so as to pass into the *minutest* channels, and become fit nutriment for the body. *Arbuthnot.*

The animal spirit and insensible particles never fall under our senses by reason of their *minuteness.*
Bentley.

In all divisions we should consider the larger and more immediate parts of the subject, and not divide it at once into the more *minute* and remote parts.
Watts's Logic.

Change of night and day,
And of the seasons ever stealing round,
Minutely faithful. *Thomson's Summer.*

General history cannot descend to *minute* details of domestick life and private transactions, the passions and foibles of great personages, &c. *Johnson.*

I do by no means advise you to throw away your time in ransacking, like a dull antiquarian, the *minute* and unimportant parts of remote and fabulous times.
Chesterfield.

MIN'UTE, *n. s.* } Lat. *minutum.* The six-
MIN'UTE-GLASS, } tieth part of an hour: any
MIN'UTE-WATCH. } small part of time: the
minute-glass and watch mark the period in question.

Tell her that I some certainty may bring;
I go this *minute* to attend the king. *Dryden.*

Casting our eyes upon a *minute-watch,* we found that from the beginning of the pumping, about two *minutes* after the coals had been put in glowing, to the total disappearing of the fire, there had passed but three *minutes.* *Boyle.*

MINX, *n. s.* Contracted probably from MINNOCK, which see. A young, pert, wanton girl.

Lewd *minx!*
Come, go with me apart. *Shakspeare.*

Some torches bore, some links,
Before the proud virago *minx.* *Hudibras.*

She, when but yet a tender *minx,* began
To hold the door, but now sets up for man.
Dryden.

MINYÆ, the ancient inhabitants of Orchomenos in Bœotia, so named from Minyas king of the country. Orchomenos the son of Minyas gave his name to the capital; but the inhabitants still retained their original appellation, in contradistinction to the Orchomenians of Arcadia. A colony of Orchomenians passed into Thessaly and settled in Iolchos; and were called Minyæ; because their chiefs were descended from the daughters of Minyas. Part of the Orchomenians accompanied the sons of Codrus when they migrated to Ionia. The Argonauts, as well as their descendants, received likewise the name of Minyæ. They were driven from Lemnos by the Pelasgi about A. A. C. 1160, and came to settle in Laconia, whence they passed into Calliste with a colony of Lacedemonians.

MINYAS, in fabulous history, a king of Bœotia, the son of Neptune by Ttitegenia, daughter of Æolus. He had six sons, of whom the most famous were Orchomenos and Athamas; and three daughters.

MIQUELETS; the inhabitants of the Southern Pyrenees, in Catalonia, and in the French departments of the Upper and Eastern Pyrenees, on the heights of the chain of mountains which forms the boundary between France and Spain. They are mostly herdsmen, hunters, coal-burners, &c. They are warlike, and inclined to plunder. They also accompany travellers on the mountain-passes, and receive high pay for their protection. In war, they are dangerous partisans, who often descend into France in troops. In the war with Napoleon, they made themselves formidable to the French troops in Catalonia.

MIQUELON; an island in the Atlantic ocean, near the southern coast of Newfoundland, belonging to France; lat. 57° 4' N.; lon. 56° 20 W. To the scuth of it lies Little Miquelon (*Petite Miquelon*), which, since 1783, has been connected with it by a sand-bank. These islands are under the direction of the commandant of St. Pierre, and are occupied only by a few families engaged in the fisheries.

MIRABEAU, count or marquis Mirabeau, a French nobleman celebrated for his literary attainments, and founder of the sect of Œconomists. He enjoyed several important offices under government. Besides several other pieces he published a famous work, entitled L'Ami des Hommes, or the Friend of Mankind. He died in 1786.

MIRABEAU (Gabriel Honore Riquteti count,

the eldest son of the preceding. was born in Paris, in 1749. He showed grea. abilities at an early age; but, having been guilty of some juvenile indiscretions, his father treated him with so much severity that he fled from his persecutions in 1769, and took refuge in Holland; where he published a book against despotism both regal and paternal. On his return to France, he was seized on a lettre de cachet, obtained by his father, and shut up in a state prison; but the walls of a dungeon could not damp the vigor of his mind, nor repress the activity of his genius; for, amidst the gloom and melancholy of a rigorous confinement, he wrote his much admired work on Lettres de Cachet, which was published soon after he had obtained his liberty, and circulated through France, and soon after through all Europe. But, while his literary fame was thus rising, his moral character was sullied by repeated scenes of dissipation, which his father in vain endeavoured to repress by successive imprisonments, insomuch that it is said he had obtained no fewer than thirty, Dr. Watkins says sixty-seven, lettres de cachet against him. But, while the old count was even meditating how to disinherit him, young Gabriel was released from farther persecution by his death. Soon after this, he travelled through Germany, Switzerland, England, and Flanders; and, upon his return, was appointed by M. de Calonne a kind of private envoy to the court of Berlin, Frederick the Great being then in his decline, and the French court wishing to be acquainted with the genius and capacity of the prince royal. The count fulfilled the object of his mission with success, and disclosed the situation, the views and characters of the Prussian court, in a work that attracted the attention of all Europe. This work was entitled The Secret History of the Court of Berlin, and was condemned by the parliament of Paris. Yet at this period the count's ambition aspired no higher than to fill some inferior diplomatic office. But M. de Calonne either did not justly appreciate his abilities, or viewed them with envy; for he neither gave him a new appointment, nor properly rewarded him for what he had done. But Mirabeau was ordained soon to figure in a much more conspicuous situation. At the meeting of the States of Provence, in 1787, he delivered an oration, which not only procured him the highest applause for his eloquence and patriotism, but inspired all who heard it with the same zeal for liberty and hatred of despotism that seemed to influence himself. This memorable oration procured him to be elected a member of the Constituent National Assembly, both by the citizens of Marseilles and those of Aix. He took his seat for the latter, and soon distinguished himself as the most able advocate that France had seen for the rights of the people. In that assembly of the greatest and most learned men that France ever convened together, Mirabeau was elected president. But his patriotic career was ordained to be short. In the midst of his glory and of his schemes for the permanent establishment of a free constitution under a limited monarchy, he was seized with a rheumatic gout, which from its commencement prognosticated a fatal issue. All Paris was in anxious alarm, but although he had the best medical advice he died on the 2nd of April, 1791. He continued to the last to talk of public affairs, and, when no longer able to converse, expressed his sentiments on some important subjects in writing. His works consist of eighteen treatises, chiefly in favor of democracy.

MIRABILIS, marvel of Peru, a genus of the monogynia order and pentandria class of plants: COR. funnel-shaped above: CAL. inferior; the nectarium globular, containing the germen. The most remarkable species are these:—

1. M. dichotoma, the dichotomous, or forked marvel, has a thick fleshy root, an upright, thick, swollen, jointed stem, branching forkedly two or three feet high; oblong opposite leaves, and smallish red flowers at the axillas, singly and close-sitting.

2. M. jalappa, the common marvel of Peru. It has a large, thick, fleshy root, an upright, thick, jointed stalk, dividing and branching numerously, widely, and erectly, a yard or more high; garnished with oblong, broad, opposite leaves; and all the branches and shoots terminated by numerous flowers in clusters, of different colors in the varieties. Of these there are varieties with, 1. white flowers; 2. yellow; 3. purple; 4. red; 5. white and yellow; 6. white and purple; 7. purple and yellow; 8. red and yellow flowers. Several other varieties often rise from seed; but, although several of the above colors and variegations are sometimes common to the same plant, yet it is rare that a plant of this species produces flowers of one of these colors alone; sometimes, however, the same plant will exhibit only white and purple flowers separate, and sometimes both colors in the same flowers, intermixed with the plain ones; the same is also observable in the red and yellow; others have plain flowers of several different colors, and sometimes of variegated flowers also on the same plant. This species has a large tap root, which, when cut across, resembles that of the true jalap; but, when dried, is white, light, and spongy.

3. M. longiflora, or the long flowered marvel, has a large, thick, and fleshy root, a thick stalk, dividing low into many declinated spreading branches, extending two or three feet every way; large heart-formed, hairy, viscous leaves, in opposite pairs; and all the branches and shoots terminated by white flowers in clusters, having very long tubes, nodding downward. All these plants flower in July, continuing in plentiful succession until October, very conspicuous and elegant. They have the singularity of being shut all day, and expanding towards the evening when the sun declines; hence the inhabitants of the Indies, where they grow naturally, called them four o'clock flowers; their time of opening here, however, depends on the weather; for if cloudy, or that the sun is not very vehement, they often open great part of the day. They are naturally perennial in root; but in this country are commonly considered as annuals; for they rise from seed in the spring, and the same year produce flowers and perfect

seed; and, if left to nature in the open air, totally perish in winter, at the first attack of frost or excessive rain. If in autumn, however, when the stalks begin to assume a state of decay, the roots are taken up, preserved in sand in a dry room, and planted again in spring, they shoot out afresh stronger than at first, and sometimes rise four or five feet high, with very spreading heads; or if plants growing in pots having the stems cut down in autumn, and the pots placed in a green-house, or garden frames under glasses, the roots may also be preserved sound, and will shoot out again in spring as above. The roots of all these plants are purgative; but require to be given in a great quantity to operate.

MIR'ACLE, *n. s.*
MIRAC'ULOUS, *adj.*
MIRAC'ULOUSLY, *adv.*
MIRAC'ULOUSNESS, *n. s.*
Fr. *miracle*; Lat. *miraculum*, of *miror*, to wonder. A supernatural effect or event: miraculous, by miracle, marvellous; the adverb and substantive corresponding.

And many camen to him, and seiden for dide no *miracle*. *Wiclif. John* x.

It was a singular providence of God, to draw those northern heathen nations down into those Christian parts, where they might receive Christianity, and to mingle nations so remote *miraculously* to make one blood and kindred of all people, and each to have knowledge of him. *Spenser on Ireland.*

Nothing almost sees *miracles*
But misery. *Shakspeare. King Lear*
Be not offended, nature's *miracle*,
Thou art allotted to be ta'en by me.
Shakspeare.

Arithmetical progression might easily demonstrate how fast mankind would increase, overpassing as *miraculous*, though indeed natural, that example of the Israelites, who were multiplied in two hundred and fifteen years from seventy unto six hundred thousand able men. *Raleigh's Essays.*

Restore this day, for thy great name,
Unto his ancient and *miraculous* right. *Herbert.*

Either the sun goes back in heaven, that his shadow may go back on earth; or the shadow no less *miraculously* goes back on earth, while the sun goes forward in heaven. *Bp. Hall.*

Why this strength
Miraculous yet remaining in those locks?
His might continues in thee not for naught.
Milton.

We may observe both their expectation of *miraculous* works from the Messias, and the efficacy which such works had upon them. *Barrow.*

At the first planting of the Christian religion, God was pleased to accompany it with a *miraculous* power. *Tillotson.*

Turnus was to be slain that very day; and Æneas, wounded as he was, could not have engaged him in single combat, unless his hurt had been *miraculously* healed. *Dryden.*

The *miracles* of our Lord are peculiarly eminent above the lying wonders of demons, in that they were not made out of vain ostentation of power, and to raise unprofitable amazement; but for the real benefit and advantage of men, by feeding the hungry, healing all sorts of diseases, ejecting of devils, and reviving the dead. *Bentley.*

The third by agriculture, the only honest way, wherein man receives a real increase of the seed thrown into the ground, in a kind of continal *miracle*, wrought by the hand of God in his favour. *Franklin.*

MIRACLE is defined by Dr. (now bishop) Gleig, 'an effect contrary to the established constitution and course of things, or a sensible deviation from the known laws of nature. That the universe (continues he) is governed by stated general rules, or that there is an order of causes and effects established in every part of the visible system of nature, is a fact which cannot be controverted. If the Supreme Being be the only real agent in the universe we have the evidence of experience, that, in the particular system to which we belong, he acts by stated rules. If he employs inferior agents to conduct the various motions from which the phenomena result, we have the same evidence that he has subjected those agents to certain fixed laws, commonly called the laws of nature. On either hypothesis, effects which are produced by the regular operation of these laws, or which are conformable to the established course of events, are properly called natural; and every deviation from this constitution of the natural system, and the correspondent course of events in it, is called a miracle. If this definition be just, no event can be deemed miraculous merely because it is strange, or even to us unaccountable; since it may be nothing more than a regular effect of some unknown law of nature. In this country earthquakes are rare; and for monstrous births perhaps no particular and satisfactory account can be given: yet an earthquake is as regular an effect of the established laws of nature as any of those with which we are most intimately acquainted; and, under circumstances in which there would always be the same kind of production, the monster is nature's genuine issue. It is therefore necessary, before we can pronounce any effect to be a true miracle, that the circumstances under which it is produced be known, and that the common course of nature be in some degree understood; for, in all those cases in which we are totally ignorant of nature, it is impossible to determine what is, or what is not, a deviation from its course. Miracles therefore are not as some have represented them, appeals to our ignorance. They suppose some antecedent knowledge of the course of nature, without which no proper judgment can be formed concerning them; though with it their reality may be so apparent as to prevent all possibility of a dispute. Thus, were a physician to cure a blind man of a cataract, by anointing his eyes with a chemical preparation which we had never before seen, and to the nature and effects of which we are absolute strangers, the cure would undoubtedly be wonderful; but we could not pronounce it miraculous, because, for any thing known to us, it might be the natural effect of the operation of the unguent on the eye. But were he to recover his patient merely by commanding him to see, or by anointing his eyes with clay and spittle, we should with the utmost confidence pronounce the cure to be a miracle; because we know perfectly that neither the human voice nor human saliva has, by the established constitution of things, any such power over the diseases of the eye. No one is now ignorant that persons apparently dead are often restored to their families and friends, by being treated in the manner recommended by the Humane Society. To the vulgar, and sometimes even to men of science, these

effects appear very wonderful; but, as they are known to be produced by physical agency, they can never be considered as miraculous deviations from the laws of nature. On the other hand, no one could doubt of his having witnessed a real miracle who had seen a person that had been four days dead come alive out of his grave at the call of another, or who had even beheld a person exhibiting all the symptoms of death instantly resuscitated, merely by being commanded to live. Thus it is easy, in all cases in which the course of nature is understood, to determine whether any particular event be really a miracle; while in circumstances where we know nothing of nature and its course, even a true miracle could not be admitted as such, or carry any conviction to the mind of a philosopher. If miracles be effects contrary to the established constitution of things, we are certain that they will never be performed on trivial occasions. The constitution of things was established by the Creator and Governor of the universe, and is undoubtedly the offspring of infinite wisdom pursuing a plan for the best of purposes. From this plan no deviation can be made but by God himself, or by some powerful being acting with his permission. The plans of infinite wisdom must be absolutely perfect. From this consideration, some have concluded that no miracle was ever wrought, or can rationally be expected; but mature reflection must satisfy us that all such conclusions are hasty. Man is unquestionably the principal creature in this world, and apparently the only one in it who is capable of being made acquainted with the relation in which he stands to his Creator. We cannot, therefore, doubt but that such of the laws of nature as extend not their operation beyond the limits of this earth, were established chiefly, if not solely, for the good of mankind; and if, in any particular circumstances, that good can be more effectually promoted by an occasional deviation from those laws, such a deviation may be reasonably expected. Were man, in the exercise of his mental and corporeal powers, subjected to the laws of physical necessity, the circumstances supposed would indeed never occur, and, of course, no miracle could be admitted. But such is not the nature of man.'

'Without repeating what has been said under Metaphysics,' continues this writer, 'of necessity and liberty, we shall take it for granted, that the relation between motive and actions, is different from that between cause and effect in physics; and that mankind, by their voluntary conduct, can make themselves in a great degree either happy or miserable. We know likewise from history that almost all mankind were once sunk in the grossest ignorance of the most important truths; that they knew not the Being by whom they were created and supported; that they worshipped stocks, stones, and the vilest reptiles; and that they were slaves to the most impious, cruel, and degrading superstitions. From this depraved state it was surely not unworthy of the common Father of All to rescue his helpless creatures, to enlighten their understandings that they might perceive what is right, and to present to them motives of sufficient force to engage them in the practice of it. But the understandings of ignorant barbarians cannot be enlightened by arguments; because of the force of such arguments, as regard moral science, they are not qualified to judge. The philosophers of Greece and Rome inculcated, indeed, many excellent moral precepts, and they sometimes ventured to expose the absurdities of the reigning superstition; but their lectures had no influence upon the multitude; and they had themselves imbibed such erroneous notions respecting the Supreme Being, and the nature of the human soul, and established those notions as first principles, of which they would not permit an examination, that even among them a thorough reformation was not to be expected from the powers of reasoning. It is likewise to be remarked that there are many truths, of the utmost importance to mankind, which unassisted reason could never have discovered. Among these we may reckon the immortality of the soul, the terms upon which God will be reconciled to sinners, and the manner in which the all-perfect Being may be acceptably worshipped; about all of which philosophers were in such uncertainty that, according to Plato, 'Whatever is set right, and as it should be, in the present evil state of the world, can be so only by the particular interposition of God.' (De Repub. Lib. 6). An immediate revelation from heaven, therefore, was the only method by which infinite wisdom and perfect goodness could reform a bewildered and vicious race. But this revelation must have been made directly either to some chosen individuals commissioned to instruct others, or to every man and woman for whose benefit it was ultimately intended. Were every person instructed in the knowledge of his duty by immediate inspiration, and were the motives to practise it brought home to his mind by God himself, human nature would be wholly changed: men would not be masters of their own actions; they would not be moral agents, nor be capable either of reward or punishment. It remains, therefore, that if God has been graciously pleased to enlighten and reform mankind, without destroying that moral nature which is essential to virtue, he can have done it only by revealing his truth to certain persons chosen to be the immediate instructors of their contemporaries, and through them of succeeding ages. Let us suppose this to have been the case, and consider how these inspired teachers could communicate to others every truth which had been revealed to themselves. They might easily deliver a sublime system of natural and moral science, and establish it upon the common basis of experiment and demonstration; but what foundation could they lay for those truths which unassisted reason cannot discover, and which, when revealed, appear to have no necessary relation to any thing previously known? To a bare affirmation that they had been immediately received from God, no rational being could be expected to assent. The teachers might be men of known veracity, whose simple assertion would be admitted as sufficient evidence for any fact, in conformity with the laws of nature; but, as every man has the evidence of his own consciousness and experience that revelations from heaven are deviations

from these laws, an assertion so apparently extravagant would be rejected as false, unless supported by some better proof than the mere assertion of the teacher. In this state of things, we can conceive no evidence sufficient to make such doctrines be received as the truths of God, but the power of working miracles committed to him who taught them. This would, indeed, be fully adequate to the purpose. For if there were nothing in the doctrines themselves impious, immoral, or contrary to truths already known, the only thing which could render the teacher's assertion incredible, would be its implying such an intimate communion with God as is contrary to the established course of things, by which men are left to acquire all their knowledge by the exercise of their own faculties. Let us now suppose some one of those inspired teachers to tell his countrymen that he did not desire them, on his ipse dixit, to believe that he had any preternatural communion with the deity, but that for the truth of his assertion he would give them the evidence of their own senses; and, after this declaration, let us suppose him immediately to raise a person from the dead in their presence, merely by calling upon him to come out of his grave. Would not the only possible objection to the man's veracity be removed by this miracle? and his assertion that he had received such and such doctrines from God be as fully credited as if it related to the most common occurrence? Undoubtedly it would; for, when so much preternatural power was visibly communicated to this person, no one could have reason to question his having received an equal portion of preternatural knowledge. A palpable deviation from the known laws of nature, in one instance, is a decisive proof that such a deviation is possible in another; and, in such a case as this, it is the testimony of God to the truth of a man. Miracles, then, under which we include prophecy, are the only direct evidence which can be given of divine inspiration. When a religion, or any religious truth, is to be revealed from heaven, they appear to be absolutely necessary to enforce its reception among men; and this is the only case in which we can suppose them necessary, or believe that they ever have been or will be performed. The history of almost every religion abounds with relations of prodigies and wonders, and of the intercourse of men with the gods; but we know of no religious system, those of the Jews and Christians excepted, which appealed to miracles as the sole evidence of its truth and divinity. The pretended miracles mentioned by Pagan historians and poets are not said to have been publicly wrought to enforce the truth of a new religion contrary to the reigning idolatry. Many of them may be clearly shown to have been mere natural events. See Magic. Others are represented as having been performed in secret on the most trivial occasions, and in obscure and fabulous ages long prior to the era of the writers by whom they are recorded. And such of them as at first view appear to be best attested are evidently tricks contrived for interested purposes: to flatter power, or to promote the prevailing superstitions. For these reasons, as well as on account of the immoral character of the divinities by whom they are said to have been wrought, they are altogether unworthy of examination, and carry in the very nature of them the completest proofs of falsehood and imposture. But the miracles recorded of Moses and of Christ bear a very different character. None of them is represented as wrought on trivial occasions. The writers who mention them were eye-witnesses of the facts; which they affirm to have been performed publicly, in attestation of the truth of their respective systems. They are indeed so incorporated with these systems that the miracles cannot be separated from the doctrines; and, if the miracles were not really performed, the doctrines cannot possibly be true. They were also wrought in support of revelations which opposed all the religious systems, superstitions, and prejudices, of the age in which they were given: a circumstance which of itself sets them, in point of authority, infinitely above the Pagan prodigies, as well as the lying wonders of the Romish church. It is indeed universally admitted, that the miracles mentioned in Exodus and the Gospels might, to those who saw them performed, be sufficient evidence of the divine inspiration of Moses and of Christ; but to us it may be argued that they are no evidence whatever, as we must believe in these miracles upon the bare authority of human testimony. Why, it has been asked, are not miracles wrought in all ages and countries? If the religion of Christ was to be of perpetual duration, every generation of men ought to have complete evidence of its truth and divinity. To the performance of miracles in every age and in every country, the same objections lie as to the immediate inspiration of every individual. The very end of all miracles would be defeated by their frequency. Miracles so often repeated would have no authority, because it would be difficult, if not impossible, to distinguish them from natural events. If they recurred regularly, at certain intervals, we could not prove them to be deviations from the known laws of nature, because we should have the same experience for the regular succession of preternatural effects, as for the established constitution and course of things. We may farther affirm, that for the reality of the Gospel miracles we have evidence as convincing to the reflecting mind, though not so striking, as those had who were contemporary with Christ and his apostles. and actually saw his mighty works. To the admirers of Mr. Hume's philosophy this assertion will appear an extravagant paradox; but we hope to demonstrate its truth from principles, which, consistently with himself, that author could not have denied. He has indeed endeavoured to prove (in his Essay on Miracles), that 'no testimony is sufficient to establish a miracle;' and the reasoning employed for this purpose is, 'that a miracle being a violation of the laws of nature, which a firm and unalterable experience has established, the proof against a miracle, from the nature of the fact, is as entire as any argument from experience can be; whereas our experience of human veracity, which (according to him), is the sole foundation of the evidence of testimony, is far from being uniform, and can never preponderate against that experience

which admits of no exception.' This boasted and plausible argument has with equal candor and acuteness been examined by Dr. Campbell, in his Dissertation on Miracles, who justly observes, that so far is experience from being the sole foundation of the evidence of testimony, that, on the contrary, testimony is the sole foundation of by far the greater part of what Mr. Hume calls firm and unalterable experience; and that if, in certain circumstances, we did not give an implicit faith to testimony, our knowledge of events would be confined to those which had fallen under the immediate observation of our own senses. But though Dr. Campbell has exposed the sophistry of his opponent's reasoning, and overturned the principles from which he reasons, we are persuaded that he might safely have joined issue with him upon those very principles. The testimony upon which we receive the Gospel miracles is precisely of that kind which Mr. Hume has acknowledged sufficient to establish even a miracle. 'No testimony,' says he, 'is sufficient to establish a miracle, unless the testimony be of such a kind that its falsehood would be more miraculous than the fact which it endeavours to establish. When one tells me that he saw a dead man restored to life, I immediately consider with myself whether it be more probable that this person should either deceive or be deceived, or that the fact which he relates should really have happened. I weigh the one miracle against the other; and, according to the superiority which I discover, I pronounce my decision, and always reject the greater miracle.' In this passage every reader may remark, what did not escape the perspicacious eye of Dr. Campbell, a strange confusion of terms; but as all miracles are equally easy to the Almighty, and as Mr. Hume has elsewhere observed, 'that the raising of a feather, when the wind wants ever so little of a force requisite for that purpose, is as real a miracle as the raising of a house or a ship into the air;' candor obliges us to suppose, that by talking of greater and less miracles, and of always rejecting the greater, he meant nothing more, but that, of two deviations from the known laws of nature, he always rejects that which in itself is least probable. If, then, we can show that the testimony given by the apostles and other first preachers of Christianity, to the miracles of their master, would, upon the supposition that those miracles were not really performed, have been as great a deviation from the known laws of nature as the miracles themselves, the balance must be considered as evenly poised by opposite miracles; and, whilst it continues so, the judgment must remain in a state of suspense. But, if it shall appear, that in this case the false testimony would have been a deviation from the laws of nature, less probable in itself than the miracles recorded in the Gospels, the balance will be instantly destroyed; and, by Mr. Hume's maxim, we shall be obliged to reject the supposition of falsehood in the testimony of the apostles, and admit the miracles of Christ to have been really performed. In this argument we need not waste time in proving that those miracles, as they are represented in the New Testament, were of such a nature, and performed before so many witnesses, that no imposition could possibly be practised on the senses of those who affirm that they were present. From every page of the Gospels this is so evident, that the philosophical adversaries of the Christian faith never suppose the apostles to have been themselves deceived, but boldly accuse them of bearing false witness. But, if this accusation be well founded, their testimony itself is as great a miracle as any which they record of themselves or of their master. It has been shown elsewhere that by the law of association, which is one of the laws of nature, mankind, in the very process of learning to speak, necessarily learn to speak the truth; that ideas and relations are in the mind of every man so closely associated with the words by which they are expressed in his native tongue, and in every other language of which he is master, that the one cannot be entirely separated from the other; that therefore no man can on any occasion speak falsehood without some effort; that by no effort can a man give consistency to any premeditated detail of falsehood, if it be of any length, and include a number of particulars; and that it is still less possible for several men to agree in such a detail, when at a distance from each other, and cross-questioned by their enemies. It therefore follows, if the testimony of the apostles to their own and their Master's miracles be false, either that they must have concerted a consistent scheme of falsehood, and agreed to publish it at every hazard; or that God, or some powerful agent appointed by him, must have dissolved all the associations formed in their minds between the ideas of sense and the words of language, and arbitrarily formed new associations, all in exact conformity to each other, but all in direct contradiction to truth. One or other of these events must have taken place, because, upon the supposition of falsehood, there is no other alternative. But such a dissolution and formation of associations as the latter implies, must, to every man who shall attentively consider it, appear to be as real a miracle, and to require as great an exertion of power, as the resurrection of the dead. Nor is the supposed voluntary agreement of the apostles in a scheme of falsehood an event less miraculous. The very resolution of the apostles to propagate the belief of false miracles, in support of such a religion as that which is taught in the New Testament, is as great a miracle as human imagination can easily conceive. When they formed this design, either they must have hoped to succeed, or they must have foreseen that they should fail in their undertaking; and, in either case, they chose evil for its own sake They could not, if they foresaw that they should fail, look for any thing but that contempt, disgrace, and persecution, which were the inevitable consequences of an unsuccessful endeavour to overthrow the established religion. Nor could their prospects be brighter upon the supposition of their success. As they knew themselves to be false witnesses, and impious deceivers, they could have no hopes beyond the grave; and by determining to oppose all the religious systems, superstitions, and prejudices of the ages in which they lived, they wilfully exposed themselves to inevitable misery in the present life, to insult and imprisonment, to stripes and

death. Nor can it be said that they might look forward to power and affluence when they should, through suffering, have converted their countrymen; for so desirous were they of obtaining nothing but misery at the end of their mission, that they made their own persecution a test of the truth of their doctrines. They introduced the Master, from whom they pretended to have received these doctrines, as telling them that 'they were sent forth as sheep in the midst of wolves; that they should be delivered up to councils, and scourged in synagogues; that they should be hated of all men for his name's sake; that the brother should deliver up the brother to death, and the father the child; and that he who took not up his cross and followed after him was not worthy of him.' The very system of religion, therefore, which they invented and resolved to impose upon mankind, was so contrived, that the worldly prosperity of its first preachers, and even their exemption from persecution, was incompatible with its success. Had these clear predictions of the Author of that religion, under whom the apostles acted only as ministers, not been verified, all mankind must have perceived that their pretence to inspiration was false, and that Christianity was a scandalous and impudent imposture. All this the apostles could not but foresee, when they formed their plan for deluding the world. Whence it follows, that, when they resolved to support their pretended revelation by an appeal to forged miracles, they wilfully, and with their eyes open, exposed themselves to inevitable misery, whether they should succeed or fail in their enterprize; and that they concerted their measures so as not to admit of the possibility of a recompense to themselves, either in this life or that which is to come. But if there be a law of nature, for the reality of which we have better evidence than we have for others, it is, that 'no man can choose misery for its own sake,' or make the acquisition of it the ultimate object of his pursuit. The existence of other laws of nature we know by testimony and our own observation of their effects. The existence of this law is known to us not only by these means, but also by the still clearer and more conclusive evidence of our own consciousness. Thus, then, do miracles force themselves upon our assent in every possible view which we can take of this interesting subject. If the testimony of the first teachers of Christianity was true, the miracles recorded in the Gospel were certainly performed, and the doctrines of our religion are derived from heaven. But, if that testimony was false, either God must have miraculously effaced from the minds of those by whom it was given all the associations formed between their sensible ideas and the words of language, or he must have endowed those men with the gift of prescience, and have impelled them to fabricate a pretended revelation for the purpose of deceiving the world, and involving themselves in certain and foreseen destruction. The power necessary to perform the one series of these miracles may be as great as that which would be requisite for the performance of the other; and, considered merely as exertions of preternatural power, they may seem to balance each other, and to hold the mind in a state of suspense. But, when we take into consideration the different purposes for which these opposite miracles were wrought, the balance is instantly destroyed. The miracles recorded in the Gospels, if real, were wrought in support of a revelation, which, in the opinion of all by whom it is received, has brought to light many important truths, which could not otherwise have been made known to men; and which, by the confession of its adversaries, contains the purest moral precepts by which the conduct of mankind was ever directed. The opposite series of miracles, if real, was performed to enable, and even to compel a company of Jews, of the lowest rank, and of the narrowest education, to fabricate, with the view of inevitable destruction to themselves, a consistent scheme of falsehood, and by an appeal to forged miracles to impose it upon the world as a revelation from heaven. The object of the former miracles is worthy of a God of infinite wisdom, goodness, and power. The object of the latter is absolutely inconsistent with infinite wisdom and goodness. Whence it follows that the supposition of the apostles bearing false testimony to the miracles of their Master implies a series of deviations from the laws of nature infinitely less probable in themselves than those miracles; and therefore, by Mr. Hume's maxim, we must necessarily reject the supposition of falsehood in the testimony, and admit the reality of the miracles. So true is it, that, for the reality of the Gospel miracles, we have evidence as convincing to the reflecting mind, as those had who were contemporary with Christ and his apostles, and were actual witnesses to their mighty works.' See THEOLOGY.

MIRANDA, a river of Spain, which, rising among the mountains of Asturias, flows northwards, separates that province from Galicia, and falls into the Atlantic.

MIRANDA DE CORVO, a town of the province of Beira, Portugal, on the river Duca. Population 2700. Twelve miles south-east of Coimbra.

MIRANDA (Francis), a South American revolutionary general, was a native of Peru. He entered first into the Spanish service; and, having made an attempt at Guatimala to free his countrymen, his project was prematurely discovered, and he was obliged to make his escape. He now presented to different European courts plans for the emancipation of the Spanish American colonies; and, thinking at last that the French republican government was more likely to second his schemes, he went to Paris in 1792, and connected himself with the Girondists. While waiting to commence operations in America, Miranda was offered an appointment as general of division in the army of Dumouriez. His conduct at the siege of Maestricht, and at the battle of Nerwinde, did him, it is said, no credit; and some time after he was imprisoned in consequence of his political intrigues. He was liberated in July 1794, but immediately commanded to quit the territories of France, which order he evaded. A second sentence of deportation, in 1797, obliged him to come to England. In 1804 he again repaired to Paris, where his intrigues caused him to be a third time arrested, and to be ordered by the consular government, to leave

France. He returned to America in 1806. Within five years he succeeded in revolutionising a part of the country. In 1811 he endeavoured to established a consular government at Caraccas; but his scheme was ruined by the disputes of his followers. He now fled to Carthagena, where he was taken prisoner by the Spaniards, sent to Cadiz, and thrown into a dungeon, where he remained till his death in 1816.

MIRANDOLA, a considerable fortified and inland town in the states of Modena and Italy, the capital of a province of the same name, situated on the Burana. It is defended by a citadel and castle, called La Rocca, and contains a cathedral, fifteen churches, and 8200 inhabitants, who manufacture silk and linen. Sixteen miles N. N. E. of Modena, and twenty-two south-east of Mantua.

MIRADOR', *n. s.* Span. *mirador*, *mirar*, of Lat. *miror*, to look.

Mean time your valiant son, who had before
Gained fame, rode round, to every *mirador*;
Beneath each lady's stand a stop he made,
And bowing, took the applauses which they paid.
Dryden.

MIRE, *n. s.* & *v. a.* } Belg. *moer*; Goth.
MI'RY, *adj.* } and Swed. *mira*. Mud; dirt; the foul sediment of water; to mire is to overwhelm or bespatter with mud: miry, dirty; abounding with mire.

The dog is turned to his own vomit again, and the sow that was washed to her wallowing in the *mire*.
2 *Pet.* ii. 22.

He his rider from his lofty steed,
Would have cast down, and trod in dirty *mire*.
Spenser.

Here's that, which is too weak to be a sinner, honest water, which ne'er left man i' the *mire*.
Shakspeare. Timon of Athens.

Why had I not, with charitable hand,
Took up a beggar's issue at my gates?
Who smeared thus, and *mired* with infamy,
I might have said no part of it is mine.
Shakspeare.

Shall thou and I sit round about some fountain
Looking all downwards to behold our cheeks,
How they are stained like meadows, yet not dry,
With *miry* slime left on them by a flood. *Id.*

I'm Ralph himself, your trusty squire,
Wh' has dragged your donship out o' the *mire*.
Hudibras.

Now plunged in *mire*, now by sharp brambles torn.
Roscommon.

I appeal to any man's reason, whether it be not better that there should be a distinction of land and sea, than that all should be *mire* and water.
More against Atheism.

All men who lived lazy lives, and died natural deaths, by sickness or by age, went into vast caves under ground, all dark and *miry*, full of noisome creatures, and there grovelled in endless stench and misery. *Temple.*

Deep, through a *miry* lane she picked her way,
Above her ancle rose the chalky clay.
Gay's Trivia.

So have I seen ill-coupled hounds
Drag different ways in *miry* grounds. *Swift.*

MIRECOURT, a little town of the department of the Vosges in France, and the chief place of a subprefecture, having an inferior court and a chamber of commerce. It is also a post town containin 5460 inhabitants. This town is situated in a fertile country, on the left bank of the Madon; it is generally badly built, but the suburbs are pleasant and well cultivated. It was in ancient times a place of some strength, with a good castle; but its fortifications were razed in 1670. The inhabitants carry on manufactures of lace, musical instruments of different sorts, as violins, bassviols, organs, &c., and leather; they also trade in corn, wine, brandy, sheep, wood, wrought iron goods, and the articles above mentioned. There is a public library containing 6000 volumes. It is twenty-one miles north-west of Epinal, twenty-seven east of Neufchateau, and 264 E. S. E. of Paris.

MIREVELT (Michael Jansen), portrait-painter, was the son of a goldsmith, and born at Delft in 1568. His father placed him with one of the Wierixes, of whom he learned to draw in crayons and to engrave. At the age of twelve he executed a print of the Samaritan woman; and not long after a figure of Judith holding Holofernes's head. These performances attracted the notice of Anthony Blockland, a historical painter of great note; and under his instructions Mirevelt greatly improved. He was very successful in painting history; but, finding portraits more profitable, he applied himself to portrait painting only. His reputation became so great that he exacted what price he pleased, never taking less than 150 florins a piece. His portraits are exceedingly numerous, and many of them were excellently engraved by William James Delft, a near relation, and a very skilful artist. He died in 1641.

MIREVELT (Peter), son of Michael, was born at Delft in 1596, and died in 1632. In his manner of design, style of coloring, and delicacy of pencil, he resembled his father; and by the best judges was accounted in no degree inferior to him.

MIRIAM, the sister of Aaron and Moses. It was owing to her that her mother was employed by Pharaoh's daughter as nurse to Moses. She put herself at the head of the women of Israel after their passage over the Red Sea, in order to sing the song which the men had sung before. She joined with her brother Aaron in murmuring against Moses, and was severely chastised for that action: for she became leprous, and continued separate from the rest without the camp for seven days. She died before her brothers, though in the same year, and was buried at the public expense.

MIRK'SOME, *adj.* Dan. *morck*, dark. Dark; obscure. See MURKY.

Through *mirksome* air her ready way she makes.
Faerie Queene.

MIROPOLJE, a town of European Russia, to the south of Moscow, in the government of Kursk. It contains seven churches, and 6300 inhabitants, who are employed more in agriculture than in manufactures. It is surrounded by a wall and ditch. Eighty-eight miles N. N. W. of Charkov.

MIRROR, *n. s.* Fr. *miroir*; Span. *mirar*; Lat. *miror*. An instrument valued for its bright, reflecting surface; whether of metal or glass: any thing which reflects objects; hence a pattern or example of any thing; an antitype.

If ony man is an heerer of the word, and not a doer, this schal be lickened to a man that biholdith the cheer of his birthe in a *myrrour*.
Wicliff. James i.

This *mirrour* eke that I have in min hond,
Hath swiche a might that men may in it see,
Whan ther shal falle ony adversity,
Unto your regne, or to yourself also.
Chaucer. Cant. Tales.

And in his waters, which your *mirror* make,
Behold your faces as the crystal bright. *Spenser.*

O goddess, heavenly bright,
Mirrour of grace and majesty divine.
Faerie Queene.

The works of nature are no less exact, than if she did both behold and study how to express some absolute shape or *mirror* always present before her.
Hooker.

How farest thou, *mirror* of all martial men?
Shakspeare.

That power which gave me eyes the world to view,
To view myself infused an inward light,
Whereby my soul, as by a *mirror* true,
Of her own form may take a perfect sight. *Davies.*

Less bright the moon,
But opposite in level west was set
His *mirror*, with full face borrowing her light
From him. *Milton's Paradise Lost.*

Mirroir of poets, *mirroir* of our age,
Which her whole face beholding on thy stage,
Pleased and displeased with her own faults, endures
A remedy like those whom musick cures. *Waller.*

By chance he spyed a *mirroir* while he spoke,
And gazing there beheld his altered look;
Wond'ring, he saw his features and his hue
So much were changed, that scarce himself he knew.
Dryden.

Mirroir of ancient faith in early youth. *Id.*

Late as I ranged the crystal wilds of air,
In the clear *mirroir* of thy ruling star,
I saw, alas! some dread event impend. *Pope.*

The night was dark, and the thick mist allowed
Nought to be seen save the artillery's flame,
Which arched the horizon like a fiery cloud,
And in the Danube's waters shone the same,
A *mirrored* hell! *Byron.*

MIRROR is also used for any polished body that forms the images of objects, by reflection of the rays of light. Mirrors are either plain, convex, or concave. The first reflect the rays of light in a direction exactly similar to that in which they fall upon them, and therefore represent bodies of their natural magnitude. The convex ones make the rays diverge much more than before reflection, and therefore greatly diminish the images of those objects which they show: while the concave ones, by collecting the rays into a focus, not only magnify the objects they show, but will burn very fiercely when exposed to the rays of the sun; and hence they are commonly known by the name of burning mirrors. In ancient times mirrors were made of some kind of metal; and from a passage in the Mosaic writings we learn that the mirrors used by the Jewish women were made of brass. The Jews certainly had been taught to use that kind of mirrors by the Egyptians; whence it is probable that brazen mirrors were the first kind used in the world, any metal, indeed, when well polished, will reflect very powerfully; but silver reflects the most, though it is too expensive a material for common use. Gold also is very powerful; and metals, or even wood gilded and polished, will act very powerfully as burning mirrors Even polished ivory, or straw nicely plaited together, will form mirrors capable of burning, if large. Since the invention of glass, and the application of quicksilver to it, became generally known, it has been universally employed for those plain mirrors used as ornaments to houses; but in making reflecting telescopes they have been found much inferior to metallic ones. It does not appear that the same superiority belongs to the metalline burning mirrors, considered merely as burning glasses; since the mirror with which Mr. Macquer melted platina, though only twenty-two inches diameter, and which was made of quicksilvered glass, produced much greater effects than M. Villette's metalline speculum, which considerably exceeded it in size. It is very probable, however, that this mirror of M. Villette's was by no means so well polished as it ought to have been; as the art of preparing the metal for taking the finest polish has but lately been discovered and published in the Philosophical Transactions by Mr. Mudge. See OPTICS and GLASS.

MIRTH, *n. s.*, MIRTH'FUL, *adj.*, MIRTH'LESS. Sax. myrðe. Merriment; hilarity; laughter: mirthful, cheerful; abounding in mirth or gaiety: mirthless, joyless; cheerless.

What then can move her, if nor *mirth*, nor mone
She is no woman, but a senseless stone. *Spenser.*

To give a kingdom for a *mirth*, to sit,
And keep the turn of tippling with a slave.
Shakspeare.

His eye begets occasion for his wit;
For every object that the one doth catch,
The other turns to a *mirth*-moving jest. *Id.*

No simple word,
That shall be uttered at our *mirthful* board,
Shall make us sad next morning. *Ben Jonson.*

Most of the appearing *mirth* in the world is not *mirth* but art: the wounded spirit is not seen, but walks under a disguise. *South.*

The feast was served; the bowl was crowned;
To the king's pleasure went the *mirthful* round.
Prior.

With genial joy to warm the soul,
Bright Helen mixed a *mirth* inspiring bowl.
Pope.

MIRZAPORE, a town of the province of Allahabad, Hindostan, is situated at the foot of a range of hills, on the south bank of the river Ganges, and in the district of Chunar. It is a flourishing trading town; the chief mart for silk and cotton between the British and Mahratta territories. It has also a manufacture of carpets, and iron works. The opulent merchants and indigo planters have handsome stone houses, intermixed with Hindoo temples, and flights of stone stairs leading to the river. Long. 83° 35 E., lat. 25° 10′ N.

MIRZAPORE, a town of Hindostan, province of Berar, formerly the capital of the district of Corair, belonging to the Chohan rajah, a tributary of the Mahrattas. There are several small places of the same name in India.

MISACCEPTA'TION, *n. s.* Of Fr. *mis*, and Teut. *mes*, a prefix denoting failure, deprivation, or deviation, in all the Gothic dialects, and acceptation. The taking an expression in a wrong sense.

The apostle fears none of the currish oblatrations; but, contemning all impotent *misacceptations*, calls them what he finds them, a froward generation. *Bp. Hall.*

MISADVENTURE, *n. s.* } Fr. *mesaventure;* MISADVEN'TURED, *adj.* } mis and adventure. Mischance; misfortune; ill luck: misadventured is unfortunate.

Your looks are pale and wild, and do import
Some *misadventure.* *Shakspeare. Romeo and Juliet.*
From forth the fatal loins of these two foes,
A pair of starcrost lovers take their life;
Whose *misadventured* piteous overthrows
Do with their death bury their parents' strife. *Shakspeare.*

When a commander, either upon necessity or *misadventure*, falleth into danger, it much advanceth both his reputation, and enterprise, if bravely he behaveth himself. *Hayward.*

The body consisted, after all the losses and *misadventures*, of no less than six thousand foot. *Clarendon.*

Distinguish betwixt *misadventure* and design. *L'Estrange.*

The trouble of a *misadventure* now and then, that reaches not his innocence or reputation, may not be an ill way to teach him more caution. *Locke on Education.*

MISAIM'ED, *adj.* Mis and aim. Not aimed rightly.

The idle stroke enforcing furious way,
Missing the mark of his *misaimed* sight,
Did fall to ground. *Faerie Queene.*

MIS'ANTHROPE, *n. s.* } Fr. *misanthrope;* MISAN'THROPOS, } Gr. *μισανθρωπος,* MISAN'THROPY. } of *μισος*, hatred, and *ανθρωπος*, man. A hater of mankind: misanthropy is hatred of mankind.

I am *misanthrophos*, and hate mankind. *Shakspeare.*

Was it heresy, or phrensy, or blasphemy, or all these, in the paternians of old, revived of late times, by Postellus at Paris, that man's lower parts were of a worse author? Away with that mad *misanthropy:* there is no inch of this living pile, which doth not bewray steps of an all-wise and holy omnipotence. *Bp Hall.*

Alas, poor dean! his only scope
Was to be held a *misanthrope;*
This into general odium drew him. *Swift.*

MISAPPLICA'TION, *n. s.* } Mis and apply. MISAPPLY', *v. a.* } To apply wrongfully, or to an improper purpose.

Virtue itself turns vice, being *misapplied*,
And vice sometime by action's dignified. *Shakspeare.*

The holy treasure was to be reserved, and issued for holy uses, and not *misapplied* to any other ends. *Howel.*

The indistinction of many in the community of name, or the *misapplication* of the act of one unto another, hath made some doubt thereof. *Browne's Vulgar Errours.*

He that knows that whiteness is the name of that color he has observed in snow, will not *misapply* that word as long as he retains that idea. *Locke.*

It is our duty to be provident for the future, and to guard against whatever may lead us into *misapplications* of it. *Rogers.*

The vigilance of those who preside over these charities is so exemplary, that persons disposed to do good can entertain no suspicions of the *misapplication* of their bounty. *Atterbury.*

MISAPPREHEND', *v. a.* } Mis and appre- MISAPPREHEN'SION. } hend. Mistake; misinterpretation.

It is a degree of knowledge to be acquainted with the causes of our ignorance: what we have to say under this head, will equally concern our *misapprehensions* and errors. *Glanville.*

That your reasonings may lose none of their force by my *misapprehending* or misrepresenting them, I shall give the reader your arguments. *Locke.*

MISARRANGE'MENT, *n. s.* Mis and arrangement. Wrong arrangement, if such there be; but the word cannot be well supported.

Here glittering turrets rise, upbearing high
(Fantastic *misarrangement!*) on the roof
Large growth of what may seem the sparkling trees
And shrubs of fairy land. *Cowper.*

MISASCRIBE', *v. v.* Mis and ascribe. To ascribe falsely.

That may be *misascribed* to art which is the bare production of nature. *Boyle.*

MISASSIGN', *v. a.* Mis and assign. To assign erroneously.

We have not *misassigned* the cause of this phenomenon. *Boyle.*

MISBECOME', *v. a.* & *v. n.* Mis and become. Not to become; to be unseemly or unsuitable.

Either she has a possibility in that which I think impossible, or else impossible loves need not *misbecome* me. *Sidney.*

What to the dauphin from England?
—Scorn and defiance, slight regard, contempt,
And any thing that may not *misbecome*
The mighty sender. *Shakspeare. Henry V.*

That boldness which lads get amongst play-fellows, has such a mixture of rudeness and ill turned confidence, that those *misbecoming* and disingenuous ways of shifting in the world must be unlearned to make way for better principles. *Locke.*

Portius, thou may'st rely upon my conduct;
Thy father will not act what *misbecomes* him. *Addison.*

MISBEGOT, *adj.* } Beget or begotten with MISBEGOT'TEN. } mis. Unlawfully or irregularly begotten.

Contaminated, base,
And *misbegotten* blood, I spill of thine. *Shakspeare.*
Your words have taken such pains, as if they laboured
To bring man-slaughter into form, set quarrelling
Upon the head of valor; which, indeed,
Is valour *misbegot*, and came into the world
When sects and factions were but newly born. *Id.*
The *misbegotten* infant grows,
And, ripe for birth, distends with deadly throes
The swelling rind, with unavailing strife,
To leave the wooden womb, and pushes into life. *Dryden.*

Down, immediately, should go fools from the high places where *misbegotten* chance has perked them up, and through life should they skulk, ever haunted by their native insignificance, as the body marches accompanied by its shadow. *Burns.*

MISBEHAVE', *v. n.* } Mis and behave. To MISBEHAVED', *adj.* } act ill or improperly: untaught; ill bred.

Happiness courts thee in her best array;
But, like a *misbehaved* and sullen wench,
Thou pout'st upon thy fortune and thy love. *Shakspeare.*

The *misbehaviour* of particular persons does not at all affect their cause, since a man may act laudably in some respects, who does not so in others.
Addison's Freeholder.

MISCAL', *v. a.* Mis and call. To name improperly.

My heart will sigh when I *miscal* it so.
Shakspeare.

The third act, which connects propositions and deduceth conclusions from them, the schools call discourse; and we shall not *miscal* it if we name it reason. *Glanville's Scepsis.*

What you *miscal* their folly is their care.
Dryden.

MISCA'LCULATE, *v. a.* Mis and calculate. To reckon wrong.

Say, did I not *miscalculate* thy power,
Which, though o'ergrown it seems,
Is yet so small. *Shakspeare.*

After all the care I have taken, there may be, in such a multitude of passages, several misquoted, misinterpreted, and *miscalculated.*
Arbuthnot on Coins

MISCA'RRY, *v. n.* } Mis and carry. To
MISCAR'RIAGE, *n. s.* } fail; not to produce the intended event; not to succeed : miscarriage is, failure; ill conduct; accident.

Give them a *miscarrying* womb and dry breasts.
Hos. ix. 14.

Have you not heard of Frederick, the great soldier, who *miscarried* at sea? *Shakspeare.*

Is it concluded he shall be protector?
—It is determined, not concluded yet:
But so it must be if the king *miscarry.* *Id.*

Resolutions of reforming do not always satisfy justice, nor prevent vengeance for former *miscarriages.*
King Charles.

There must be *miscarriages* and abortions; for there died many women with child. *Graunt.*

It (charity) covereth all things, studiously conniving at real defects, and concealing assured *miscarriages*: how much more not divulging imaginary or false scandal. *Barrow.*

When a counsellor, to save himself,
Would lay *miscarriages* upon his prince,
Exposing him to public rage and hate,—
O, 'tis an act as infamously base,
As, should a common soldier sculk behind
And thrust his general in the front of war.
Dryden.

If the neglect or abuse of the liberty he had, to examine what would really make for his happiness, misleads him, the *miscarriages* that follow on it must be imputed to his own election. *Locke.*

So many politick conceptions so elaborately formed and wrought, and grown at length ripe for a delivery, do yet, in the issue, *miscarry* and prove abortive.
South's Sermons.

Your cures aloud you tell,
But wisely your *miscarriages* conceal.
Garth.

I could mention some projects which I have brought to maturity, and others which have *miscarried.*
Addison's Guardian.

A great part of that time which the inhabitants of the former earth had to spare, and whereof they made so ill use, was now employed in digging and plowing; and the excess of fertility which contributed so much to their *miscarriages,* was retracted and cut off.
Woodward's Natural History.

How, alas! will he appear in that awful day, when even the failings and *miscarriages* of the righteous shall not be concealed, though the mercy of God be magnified in their pardon. *Rogers.*

His wife *miscarried*; but the abortion proved a female fœtus. *Pope and Arbuthnot.*

You have proved yourself more tender of another's embrios, than the fondest mothers are of their own; for you have preserved every thing that I *miscarried* of. *Pope.*

No wonder that this expedient should so often *miscarry,* which requires so much art and genius to arrive at any perfection in it. *Swift.*

MISCA'ST, *v. a.* Mis and cast. To take a wrong account of.

Men *miscast* their days: for in their age they deduce the account not from the day of their birth, but the year of our Lord wherein they were born.
Browne's Vulgar Errours.

MISCELLANE', *n. s.* } Lat. *miscellaneus.*
MISCELLA'NEOUS, *adj.* } Any thing mixed;
MISCEL'LANY, *n. s.* } particularly mixed corn; miscellaneous is, mingled; composed of various kinds or ingredients: miscellany, a compound; a mass of various kinds.

It is thought to be of use to make some *miscellane* in corn; as if you sow a few beans with wheat, your wheat will be the better. *Bacon's Natural History.*

The power of Spain consisteth in a veteran army, compounded of *miscellany* forces of all nations.
Bacon.

Being *miscellaneous* in many things, he is to be received with suspicion; for such as amass all relations must err in some, and without offence be unbelieved in many. *Brown.*

And what the people but a herd confused,
A *miscellaneous* rabble, who extol
Things vulgar and well weighed scarce worth the praise? *Milton's Paradise Lost.*

I acquit myself of the presumption of having lent my name to recommend miscellanies or works of other men. *Pope.*

When they have joined their pericranies,
Out skips a book of *miscellanies.* *Swift.*

MISCHANCE', *n. s.* Mis and chance. Ill luck; ill fortune; misfortune; mishap.

The lady Cecropia sent him to excuse the *mischance* of her beasts ranging in that dangerous sort.
Sidney.

Sleep rock thy brain,
And never come *mischance* between us twain.
Shakspeare.

Extreme dealing had driven her to put herself with a great lady, by which occasion she had stumbled upon such *mischances* as were little for the honour of her family. *Sidney.*

Nothing can be a reasonable ground of despising a man but some fault chargeable upon him; and nothing can be a fault that is not naturally in a man's power to prevent; otherwise it is a man's unhappiness, his *mischance* or calamity, but not his fault.
South.

I, for their thoughtless, careless sakes,
Would here propone defences,
Their donsie tricks, their black mistakes,
Their failings and *mischances.* *Burns*

MIS'CHIEF, *n. s.* & *v. a.* } Old F. *meschef,*
MIS'CHIEF-MAKER, *n. s.* } or *mis-acheivance.*
MIS'CHIEF-MAKING, *adj.* } Harm; hurt;
MIS'CHIEVOUS, } misdeed; any
MIS'CHIEVOUSLY, *adv.* } thing ill done, ill-
MIS'CHIEVOUSNESS, *n. s.* } intentioned, or vexatious: as a verb to injure, harm (obsolete). The derivatives follow these senses.

Thy tongue deviseth *mischiefs.* *Psal.* lii. 2

The law in that case punisheth the thought; for better is a *mischief* than an inconvenience.
Spenser on Ireland.

These mad *mischiefs*
Would dare a woman.
Beaumont and Fletcher.

Come you murthering ministers!
Wherever in your sightless substances
You wait on nature's *mischief*.
Shakspeare. Macbeth.

Purely to seek God's honour, and in all our actions to regard it as our principal aim, greatly disparageth all worldly glory as vain, transitory, *mischievous*.
Barrow.

Was I cause of *mischief*, or the man,
Whose lawless lust the fatal war began?
Dryden.

I'm but a half-strained villain yet;
But mongrel *mischievous*. *Id.*

Nor was the cruel destiny content
To sweep at once her life and beauty too;
But like a hardened felon took a pride
To work so *mischievously* slow,
And plundered first, and then destroyed.
Id.

If the greatest inward heat be not sweetened by meekness, or not governed by prudence, can it bring to our souls any benefit? rather it *mischiefs* them.
Spratt's Sermons.

This false, wily, doubling disposition is intolerably *mischievous* to society. *South's Sermons.*

Compare the harmlessness, the tenderness, the modesty, and the ingenuous pliableness, which is in youth, with the *mischievousness*, the slyness, the craft, the impudence, the falsehood, and the confirmed obstinacy found in an aged, long-practised sinner.
Id.

Come not thou with *mischief-making* beauty,
To interpose between us, look not on him. *Rowe.*

He had corrupted or deluded most of his servants, telling them that their master was run mad; that he had disinherited his heir, and was going to settle his estate upon a parish boy; that if he did not look after their master he would do some very *mischievous* thing. *Arbuthnot's History of John Bull.*

States call in foreigners to assist them against a common enemy; but the *mischief* was, these allies would never allow that the common enemy was subdued. *Swift.*

To smile at a jest that plants a thorn in another's breast, is to become a principal in the *mischief*.
Sheridan.

MISCHNA, or MISNA, from שנה, iteravit, i.e. he repeated, the first part of the Jewish Talmud. The Mischna contains the text; and the Gemara, which is the second part of the Talmud, contains the commentaries. See GEMARA. The Mischna consists of various traditions of the Jews, and of explanations of several passages of Scripture: these traditions, serving as an explication of the written law, and supplement to it, are said to have been delivered to Moses during his abode on the Mount; which he afterwards communicated to Aaron, Eleazar, and Joshua. By these they were transmitted to the seventy elders, by them to the prophets, who communicated them to the men of the great sanhedrim, from whom the wise men of Jerusalem and Babylon received them. According to Prideaux, they passed from Jeremiah to Baruch, from him to Ezra, and from Ezra to the men of the great synagogue, the last of whom was Simon the Just; who delivered them to Antigonus of Socho: and from him they came down in regular succession to Simeon, who took our Saviour in his arms; to Gamaliel, by whom Paul was educated; and last of all to Rabbi Judah the Holy, who committed them to writing in the Mischna. But Dr. Prideaux, rejecting this Jewish fiction, observes, that after the death of Simeon the Just, about A. A. C. 299, the Mischnical doctors arose, who, by their comments and conclusions, added to the number of those traditions which had been received by Ezra and the men of the great synagogue; so that towards the middle of the second century, under Antoninus Pius, it was found necessary to commit these traditions to writing; especially as their country had considerably suffered under Adrian, and many of their schools had been dissolved, and their learned men cut off; and therefore the usual method of preserving their traditions had failed. Rabbi Judah on this occasion being rector of the school at Tiberias, and president of the sanhedrim in that place, undertook the work, and compiled it in six books, each consisting of several tracts, which altogether make up the number of sixty-three. Prid. Connect. vol. ii. p. 468, &c. ed. 9. This learned author computes, that the Mischna was composed about A.D. 150; but Dr. Lightfoot says, that Rabbi Judah compiled the Mischna about A.D. 190, in the end of the reign of Commodus; or, as some compute, A. D. 220. Dr. Lardner is of opinion, that this work could not have been finished before the year 190, or later. Collection of Jewish and Heathen Testimonies, &c. vol. i. p. 178. Thus the book called the Mischna was formed; a book which the Jews have generally received with the greatest veneration. The original has been published with a Latin translation by Surenhusius, with notes of his own, and others from the learned Maimonides, &c., in 6 vols. fol. Amsterdam A. D. 1698—1703. See TALMUD. It is written in a much purer style, and is not nearly so full of dreams and visions as the Gemara.

MIS'CIBLE, *adj.* Lat. *misceo.* Possible to be mingled.

Acid spirits are subtile liquors which come over in distillations, not inflammable, *miscible* with water.
Arbuthnot.

MISCITA'TION, *n. s.* Mis and citation. Unfair or false quotation.

Being charged with *miscitation* and unfair dealing, it was requisite to say something; honesty is a tender point. *Collier.*

MISCLAIM', *n. s.* Mis and claim. Mistaken claim.

Error, *misclaim*, and forgetfulness, become suitors for some remission of extreme rigour. *Bacon.*

MISCOMPUTA'TION, *n. s.* Mis and computation. False reckoning.

It was a general misfortune and *miscomputation* of that time, that the party had so good an opinion of their own reputation and interest. *Clarendon.*

MISCONCEIT', *n. s.*
MISCONCEIVE', *v. a.*
MISCONCEP'TION, *n. s.*
Mis and conceit, and conception. False opinion, or notion: to misconceive is to misjudge; have a false notion of.

Nor let false whispers, breeding hidden fears,
Break gentle sleep with *misconceived* doubt.
Spenser.

Our endeavour is not so much to overthrow them with whom we contend, as to yield them just and reasonable causes of those things, which, for want of due consideration heretofore, they *misconceived*. *Hooker.*

The other which instead of it we are required to accept is only by error and *misconceit* named the ordinance of Jesus Christ; no one proof being as yet brought forth, whereby it may clearly appear to be so in very deed. *Id.*

Misconceived Joan of Arc hath been
A virgin from her tender infancy.
Shakspeare. Henry VI.

It cannot be that our knowledge should be other than an heap of *misconception* and error. *Glanville.*

Great errors and dangers result out of *misconception* of the names of things.
Harvey on Consumption.

It will be a great satisfaction to see those pieces of most ancient history, which have been chiefly preserved in scripture, confirmed anew and freed from those *misconceptions* or misrepresentations which made them sit uneasy upon the spirits even of the best men. *Burnet's Theory of the Earth.*

MISCON'DUCT, *n. s.* Mis and conduct. Ill behaviour; ill management.

They are industriously proclaimed and aggravated by such as are guilty or innocent of the same slips or *misconducts* in their own behaviour. *Addison.*

It highly concerned them to reflect, how great obligations both the memory of their past *misconduct*, and their present advantages, laid on them, to walk with care and circumspection. *Roger's Sermons.*

MISCONJEC'TURE, *n. s.* Mis and conjecture. A wrong guess.

I hope they will plausibly receive our attempts, or candidly correct our *misconjectures*. *Browne.*

MISCON'STRUE, *v. a.* } Mis and construe.
MISCONSTRUC'TION, *n. s.* } To interpret wrong: wrong interpretation.

That which, by right exposition, buildeth up Christian faith, being *misconstrued* breedeth error; between true and false construction the difference reason must shew. *Hooker.*

We would have had you heard
The manner and the purpose of his treasons;
That you might well have signified the same
Unto the citizens, who, haply, may
Misconstrue us in him. *Shakspeare. Richard III.*

It pleased the king, his master, very lately
To strike at me upon his *misconstruction*,
When he conjunct, and flattering his displeasure,
Tript me behind. *Id. King Lear.*

Many of the unbelieving Israelites would have *misconstrued* this story of mankind. *Raleigh.*

Others conceive the literal acceptation to be a *misconstruction* of the symbolical expression.
Browne.

Those words were very weakly inserted where they are so liable to *misconstruction*. *Stillingfleet.*

Do not, great Sir, *misconstrue* his intent,
Nor call rebellion what was prudent care,
To guard himself by necessary war. *Dryden.*

A virtuous emperor was much afflicted to find his actions *misconstrued* and defamed by a party.
Addison.

MISCOUN'SEL, *v. a.* Mis and counsel. To advise wrong.

Every thing that is begun with reason
Will come by ready means unto his end,
But things *miscounselled* must needs miswend.
Spenser.

MIS'CREANCE, *n. s.* } Fr. *mescreance*, or
MIS'CREANCY, } *mescroiance*. Unbe-
MIS'CREANT. } lief; false faith; adherence to a false religion: a miscreant is strictly one that holds a false faith; hence a bad man of any kind; a wretch.

If thou wilt renounce thy *miscreance*,
And my true liegeman yield thyself for ay,
Life will I grant thee for thy valiance.
Spenser.

Their prophets justly condemned them as an adulterous seed, and a wicked generation of *miscreants*, which had forsaken the living God. *Hooker.*

Now, by Apollo king,
Thou swear'st thy gods in vain.
—O vassal, *miscreant*.
Shakspeare. King Lear.

How unnatural is the villainy of those *miscreants*, that can be content to be actors in capital wrongs offered to sovereign authority. *Bp. Hall.*

The more usual causes of deprivation are murder, man-slaughter, heresy, *miscreancy*, atheism, simony.
Ayliffe.

If extraordinary lenity proves ineffectual, those *miscreants* ought to be made sensible that our constitution is armed with force.
Addison's Freeholder.

MISCREATE', *adj.* } Mis and create. Pro-
MISCREA'TED. } duced unnaturally or illegitimately; made as by a blunder.

Then made he head against his enemies,
And Ymner slew or Logis *miscreate*.
Faerie Queene.

Eftsoons he took that *miscreated* fair,
And that false other sprite, on whom he spread
A seeming body of the subtile air. *Spenser.*

God forbid, my lord,
That you should fashion, wrest, or bow your reading;
With opening titles *miscreate*, whose right
Suits not in native colours with the truth.
Shakspeare.

MISDEED', *n. s.* Mis and deed. Evil action.

O God,
If thou wilt be avenged on my *misdeeds*,
Yet execute thy wrath on me alone. *Shakspeare.*
Evils which our own *misdeeds* have wrought.
Milton.

Chased from a throne, abandon'd, and exil'd
For foul *misdeeds* were punishments too mild.
Dryden.

MISDEEM', *v. a.* Mis and deem. To judge ill of; to mistake.

All unweeting an enchanter bad
His sense abus'd, and made him to *misdeem*,
My loyalty, not such as it did seem.
Faerie Queene.

Besides, were we unchangeable in will,
And of a wit that nothing could *misdeem*;
Equal to God whose wisdom shineth still
And never errs, we might ourselves esteem.
Davies.

MISDEMEAN', *v. a.* } Mis and demean.
MISDEME'ANOR, *n. s.* } To behave ill: misdemeanor is offence; ill behaviour; something less than an atrocious crime.

From frailty
And want of wisdom, you, that best should teach us,
Have *misdemeaned* yourself.
Shakspeare. Henry VIII.

The house of commons have only power to censure the members of their own house, in point of election or *misdemeanors*, in or towards that house. *Bacon.*

It is no real disgrace to the church merely to lose her privileges, but to forfeit them by her fault or *misdemeanor*. *South.*

These could never have touched the head, or stopped the source of these unhappy *misdemeanors*, for which the punishment was sent. *Woodward.*

MISDEVOTION, *n. s.* Mis and devotion. Mistaken piety.

A place, where *misdevotion* frames
A thousand prayers, to saints, whose very names
The church knew not, heaven knows not yet.
Donne.

MISDI'ET, *n. s.* Mis and diet. Improper food.

A dropsy through his flesh did flow,
Which by *misdiet* daily greater grew.
Faerie Queene.

MISDISTIN'GUISH, *v. a.* Mis and distinguish. To make wrong distinctions.

If we imagine a difference where there is none, because we distinguish where we should not, it may not be denied that we *misdistinguish*. *Hooker.*

MISDO', *v. a.* & *v. n.* } Mis and do. To do
MISDO'ER, *n. s.* } wrong; to commit;
MISDO'ING, *n. s.* } faults; a misdoer is, an offender; criminal: misdoing, offence; deviation from right.

Were they not contained in duty with a fear of law, which inflicteth sharp punishments to *misdoers*, no man should enjoy any thing. *Spenser on Ireland.*

Afford me place to show what recompence
T'wards thee I intend for what I have *misdone*.
Milton.

Try the erring soul
Not wilfully *misdoing*, but unaware
Misled. *Id. Paradise Regained.*

I have *misdone*, and I endure the smart,
Loth to acknowledge, but more loth to part.
Dryden.

The worst is, to think ourselves safe so long as we keep our injuries from the knowledge of men, and out of our own view, without any awe of that all-seeing eye that observes all our *misdoings*. *L'Estrange.*

MISDOUBT', *v. a.* & *n. s.* Mis and doubt. To suspect of deceit or danger: suspicion of crime or danger.

If she only *misdoubted* me, I were in heaven; for quickly I would bring sufficient assurance. *Sidney.*

The bird that hath been limed in a bush,
With trembling wings *misdoubteth* every bush
And I, the hapless male to one sweet bird,
Have now the fatal object in my eye,
Where my poor young was limed, was caught, and killed. *Shakspeare. Henry VI.*

York, steel thy fearful thoughts,
And change *misdoubt* to resolution.
Shakspeare.

To believe his wiles my truth can move,
Is to *misdoubt* my reason or my love. *Dryden.*

MISE, in law, is used in various senses: sometimes for costs or expenses; in which sense it is commonly used in entering of judgments in actions personal. It is also used for the issue to be tried on the grand assize; in which case, joining of the mise upon the mere right is putting in issue, between the tenant and demandant, Who has the best or clearest right?

MISE also signifies a tax or tallage, &c. An honorary gift, or customary present from the people of Wales to every new king or prince of Wales, anciently given in cattle, wine, and corn, but now in money, being £5000 or more, is denominated a mise: so was the usual tribute of 3000 merks paid by the inhabitants of the county palatine of Chester at the change of every owner of the said earldoms, for enjoying their liberties. At Chester they have a mise-book, wherein every town and village in the county is rated what to pay towards the mise. The 27 Hen. VII. c. 26 ordains that lords shall have all such mises and profits of their lands as they had in times past, &c.

MISE is sometimes also corruptly used for mease, in law French mees, a message; as a mise place, in some manors, such a message or tenement as answers the lord a heriot at the death of its owner.

MISEMPLOY', *v. a.* } Mis and employ.
MISEMPLOY'MENT, *n. s.* } To use to wrong purposes: improper application.

An improvident expense, and *misemployment* of their time and faculties. *Hale's Origin of Mankind.*

Their frugal father's gains they *misemploy*,
And turn to point and pearl, and every female toy.
Dryden.

Some, taking things upon trust, *misemploy* their powers by lazily enslaving their minds to the dictates of others. *Locke.*

That vain and foolish hope, which is *misemployed* on temporal objects, produces many sorrows. *Addison's Spectator.*

They grew dissolute and profane: and, by *misemploying* the advantages which God had thrown into their lap, provoked him to withdraw them. *Atterbury.*

MISENUM, or MISENUS, in ancient geography, a promontory, port, and town of Italy, in Campania, south-west of Baiæ, in the Sinus Puteolanus, on the north side. Here Augustus had a fleet, called Classis Misenensis, for guarding the Mare Inferum; as he had another at Ravenna for the Superum. On this peninsula a villa was built by Caius Marius, with a degree of elegance that gave great offence to the more austere among the Romans, who thought it ill suited to the character of so rough a soldier. Upon the same foundation Lucullus, the plunderer of the eastern world, erected an edifice, in comparison of which the former house was a cottage; but even his magnificence was eclipsed by the splendor of the palace which the emperors raised upon the same spot. To these proud abodes of heroes and monarchs, which have long been levelled to the ground, a few fishing huts, as Mr. Swinburn informs us, and a lonely public house, have succeeded; hither boatmen resort to tipple, perhaps on the identical site where the voluptuous masters of the world quaffed Chian and Falernian wines.

MI'SER, *n. s.* Lat. *miser*. An unhappy wretch; hence, particularly, a covetous wretch: one who in wealth is miserable for the fear of poverty.

Do not disdain to carry with you the woeful words

of a miser now despairing; neither be afraid to appear before her bearing the base title of the sender. *Sidney.*

Fair son of Mars, that seek with warlike spoil
And great atchievements, great yourself to make,
Vouchsafe to stay your steed for humble *miser's* sake. *Spenser.*

Decrepit *miser!* base ignoble wretch!
I am descended of a gentler blood. *Shakspeare.*

Though she be dearer to my soul than rest
To weary pilgrims, or to *misers* gold,
Rather than wrong Castalio I'd forget her. *Otway.*

No silver saints by dying *misers* giv'n,
Here bribed the rage of ill-requited heaven;
But such plain roofs as piety could raise,
And only vocal with the Maker's praise. *Pope.*

MIS'ERABLE, *adj.* } Fr. *miserable;* Lat. MIS'ERABLY, *adv.* } *miser.* Unhappy; MIS'ERY, *n. s.* } wretched; mean; sordid: miserably is, unhappily, calamitously; meanly: misery, is also used both for wretchedness, unhappiness, calamity, and in an obsolete sense for covetousness, avarice.

Miserable comforters are ye all. *Job.* xvi. 2.

As the love I bear you makes me thus invite you, so the same love makes me ashamed to bring you to a place where you shall be so, not spoken by ceremony but by truth, *miserably* entertained. *Sidney.*

O nation *miserable,*
With an untitled tyrant, bloody sceptered!
When shalt thou see thy wholesome days again? *Shakspeare.*

My heart is drowned with grief,
My body round engirt with *misery.* *Id.*

He looked upon things precious as they were
The common muck o' th' world: he covets less
Than *misery* itself would give. *Shakspeare. Coriolanus.*

When we our betters see bearing our woes
We scarely think our *miseries* our foes. *Shakspeare.*

He that hath pity on another man's sorrow, shall be free from it himself, and he that delighteth in, and scorneth the *misery* of another, shall one time or other fall into it himself. *Raleigh.*

In a fabrick of a forty thousand pounds charge, I wish thirty pounds laid out before in an exact model; for a little *misery* may easily breed some absurdity of greater charge. *Wotton.*

What hopes delude thee, *miserable* man? *Dryden.*

MISERERE (Latin, *have mercy*); the name of a celebrated church song, taken from the fifty-seventh psalm, beginning, in the Vulgate, *Miserere mei, Domine.* The *miserere* forms part of certain liturgies, and various great composers have taken it as a subject. The *miserere* of Allegri (q. v.) is particularly famous; and this alone, sung by the Papal choir, in the *capella Sistina,* in the Passion week, would repay the trouble of a visit to the "eternal city."

MISERERE is also the name given to pictures representing the dying Saviour. A terrible disease, produced by obstruction of the bowels, is also called by this name.

MISERICORDIA, in law, an arbitrary fine imposed on any person for an offence: this is called misericordia, because the amercement ought to be but small, and less than that required by magna charta. If a person be outrageously amersed in a court that is not of record, the writ called moderata misericordia lies for moderating the amercement according to the nature of the fault.

MISERICORDIA (mercy; in Greek, ἔλεος) was personified as a deity. She had a celebrated altar in the market-place of Athens, constituting an asylum. *Misericordias Domini* is the name given to the second Sunday after Easter, because the mass for this day begins with *Misericordias Domini cantabo in æternum.* *Misericorde* (French) was also the name of the dagger of the knights in the middle ages. Fauchet derives its name from its putting men out of pain when irrecoverably wounded, or from the sight of it causing the vanquished to cry out for mercy.

MISFASHION, *v. a.* Mis and fashion. To form wrong.

MISFORM, *v. a.* Mis and form. To put in an ill form.

His monstrous scalp down to his teeth it tore,
And that *misformed* shape misshaped more. *Spenser.*

MISFOR'TUNE, *n. s.* Mis and fortune. Calamity; ill luck; want of good fortune.

Fortune thus 'gan say, misery and *misfortune* is all one,
And of *misfortune,* fortune hath only the gift. *Sidney.*

MISFORTUNE, or chance, in law, is a deficiency of the will in committing an unlawful act; or by chance, and not by design. In such case the will does not co-operate with the deed; which, therefore, wants one main ingredient of a crime. See CRIME. For this, when it affects the life of another, see the article HOMICIDE. Here we need only observe that if any accidental mischief happens to follow from the performance of a lawful act, the party stands excused from all guilt: but if a man be doing any thing unlawful, and a consequence ensues which he did not foresee or intend, as the death of a man or the like, his want of foresight shall be no excuse; for being guilty of one offence, in doing antecedently what is in itself unlawful, he is criminally guilty of whatever consequence may follow the first misbehaviour.

MISGIVE', *v. a.* } Mis and give. To fill MISGIV'ING, *n. s.* } with doubt; deprive of confidence. Used with the reciprocal pronoun: misgiving is doubt; distrust.

As Henry's late presaging prophecy
Did glad my heart with hope of this young Richmond;
So doth my heart *misgive me* in these conflicts
What may befal him, to his harm or ours. *Shakspeare.*

Yet oft his heart divine of something ill,
Misgave him. *Milton.*

If a conscience thus qualified and informed, be not the measure by which a man may take a true estimate of his absolution, the sinner is left in the plunge of infinite doubts, suspicions, and *misgivings,* both as to the measures of his present duty, and the final issues of his future reward. *South.*

His heart *misgave him,* that these were so many meeting-houses; but, upon communicating his suspicions, I soon made him easy. *Addison's Freeholder.*

MISGOV'ERN, *v. a.* | Mis and govern.
MISGOV'ERNED, *adj.* | To govern ill; admi-
MISGOV'ERNANCE, *n. s.* | nister unfaithfully:
MISGOV'ERNMENT, *n. s.* | misgovernment is, rude; uncivilised: misgovernance, irregularity; synonymous with misgovernment, or ill administration of affairs.

Thy muse too long slumbereth in sorrowing
Lulled asleep through love's *misgovernance*.
Spenser.

Solyman charged him bitterly, that he had *misgoverned* the state, and inverted his treasures to his own use. *Knolles.*

Rude, *misgoverned* hands, from window tops,
Threw dust and rubbish on King Richard's head.
Shakspeare.

There is not chastity enough in language,
Without offence, to utter them: thus, pretty lady,
I am sorry for thy much *misgovernment*. *Id.*

Men lay the blame of those evils whereof they know not the ground, upon public *misgovernment*. *Raleigh's Essays.*

Men are miserable, if their education hath been so undisciplined as to leave them unfurnished of skill to spend their time; but most miserable, if such *misgovernment* and unskilfulness make them fall into vicious company. *Taylor.*

MISGUIDE', *v. a.* | Mis and guide. To
MISGUI'DANCE, *n. s.* | direct ill or wrong: misguidance, false direction.

The Nicene council fixed the equinox the twenty-first of March for the finding out of Easter: which has caused the *misguidance* from the sun which we lie under in respect of Easter, and the moveable feasts. *Holder on Time.*

Hunting after arguments to make good one side of a question, and wholly to neglect those which favor the other, is wilfully to *misguide* the understanding; and, is so far from giving truth its due value, that it wholly debases it. *Locke.*

Whosoever deceives a man makes him ruin himself; and by causing an error in the great guide of his actions, his judgment, he causes an error in his choice, the *misguidance* of which must naturally engage him to his destruction. *South.*

Misguided prince! no longer urge thy fate,
Nor tempt the hero to unequal war. *Prior.*

Of all the causes which conspire to blind
Man's erring judgment, and *misguide* the mind,
What the weak head with strongest bias rules
Is pride, the never-failing vice of fools. *Pope.*

MISHAP', *n. s.* Mis and hap. Ill chance or luck; calamity.

To tell you what miserable *mishaps* fell to the young prince of Macedon his cousin, I should too much fill your ears with strange horrours. *Sidney.*

Since we are thus far entered into the consideration of her *mishaps*, tell me, have there been any more such tempests wherein she hath thus wretchedly been wrecked? *Spenser.*

Rome's readiest champions, repose you here,
Secure from worldly chances and *mishaps*.
Shakspeare.

It cannot be
But that success attends him; if *mishap*,
Ere this he had returned, with fury driven,
By his avengers; since no place like this
Can fit his punishment, or your revenge. *Milton.*

If the worst of all *mishaps* hath fallen,
Speak; for he could not die unlike himself.
Denham.

MISINFER', *v. a.* Mis and infer. To infer wrong.

Nestorius teaching rightly, that God and man are distinct natures, did thereupon *misinfer*, that in Christ those natures can by no conjunction make one person. *Hooker.*

MISINFORM', *v. a.* | Mis and inform.
MISINFORMA'TION, *n. s.* | To deceive by false accounts: misinformation, false intelligence; false accounts.

Some belonged to a man of great dignity, and not as that wicked Simon had *misinformed*.
2 *Mac.* iii. 11.

By no means trust to your servants, who mislead you, or *misinform* you; the reproach will lie upon yourself. *Bacon.*

Let not such be discouraged as deserve well, by *misinformation* of others, perhaps out of envy or treachery. *Id.*

Bid her well beware,
Lest, by some fair appearing good surprised,
She dictate false; and *misinform* the will
To do what God expressly hath forbid. *Milton.*

The vengeance of God, and the indignation of men, will join forces against an insulting baseness, when backed with greatness, and set on by *misinformation*. *South's Sermons.*

MISINTER'PRET, *v. a.* Mis and interpret. To explain to a wrong sense, or wrong intention.

The gentle reader rests happy to hear the worthiest works *misinterpreted*, the clearest actions obscured, and the innocentest life traduced. *Ben Jonson.*

After all the care I have taken, there may be several passages misquoted and *misinterpreted*.
Arbuthnot on Coins.

MISJOIN', *v. a.* Mis and join. To join unfitly or improperly.

In reason's absence mimick fancy wakes
To imitate her; but *misjoining* shapes,
Wild work produces oft, and most in dreams;
Ill-matching words, and deeds, long past, or late.
Milton.

Luther, more mistaking what he read,
Misjoins the sacred body with the bread.
Dryden.

MISITRA, a town of Modern Greece, the capital of the Morea, renowned in the ancient history of Greece under its original names of LACEDÆMON and SPARTA. See these articles. It has an impregnable castle seated on a rock; several churches, one of them called Perileptos, said to be one of the most beautiful in the world; a superb Turkish mosque and hospital, with three Jewish synagogues; and two large suburbs. It is the see of a Greek archbishop; the residence of a bey, an aga, and a waywode; and contains about 12,000 inhabitants. It is seated on the Vasilipotamo, forty miles S. S. W. of Argos, forty E. N. E. of Navarin, sixty south of Corinth, ninety east of Lepanto, and ten south-west of Athens or Setines. It was taken by the Russians in 1770. Long. 22° 30′ E., lat. 37° 11′ N.

MISJUDGE', *v. n.* & *v. a.* Mis and judge. To form false opinions; judge ill: to mistake; judge ill of.

You *misjudge*;
You see through love, and that deludes your sight;
As, what is straight, seems crooked through the water. *Id.*

Where we *misjudge* the matter, a miscarriage draws pity after it; but, when we are transported by pride, our ruin lies at our own door. *L'Estrange.*

By allowing himself in what is innocent, he breeds offence to his weak and *misjudging* neighbour. *Atterbury.*

Insensate!
Too long *misjudging* have I thought thee wise,
But sure relentless folly steels thy breast. *Pope.*

MISKOLCZ, a considerable and well built town of Hungary, in the county of Borschod, of which it is the capital. It contains 13,600 inhabitants, the majority of whom are Maggars, or Hungarians proper; the rest are Slowacs, Russniacks, Walachians, Germans, Greeks, Jews, and gypsies. The greater number are Calvinists, who have one of their gymnasia or high schools here, as well as several elementary schools. The Catholics, Lutherans, and Greeks have their own churches; the Jews a synagogue; and the Minorites a monastery. There are no extensive manufacturing establishments. It is thirty-three miles west of Tokay.

MISLAY', *v. a.* } Mis and lay. To lay in MISLAYER', *n. s.* } a wrong place: one that puts in a wrong place.

The *mislayer* of a mere stone is to blame; but the unjust judge is the capital remover of landmarks, when he defineth amiss of lands. *Bacon.*

Mean time my worthy wife our arms *mislayed*,
And from beneath my head my sword conveyed. *Dryden.*

The fault is generally *mislaid* upon nature; and there is often a complaint of want of parts, when the fault lies in want of a due improvement. *Locke.*

If the butler be the tell-tale, *mislay* a spooon, so as he may never find it. *Swift's Rules to Servants.*

MISLEAD', *v. a.* } Preterite and participle MISLEAD'ER, *n. s.* } passive misled. Mis and lead. To guide a wrong way; to betray to mischief or mistake: one that leads to ill.

They have disclaimed and abandoned those heretical phantasies touching our Saviour, wherein by their *misleaders* they had been anciently plunged. *Brerewood on Languages.*

Take, oh take those lips away,
That so sweetly were forsworn;
And those eyes, the break of day,
Lights that do *mislead* the morn. *Shakspeare.*

When thou dost hear I am as I have been,
Approach me, and thou shalt be as thou wast,
The tutor and the feeder of my riots;
Till then I banish thee on pain of death,
As I have done the rest of my *misleaders*. *Id.*

Trust not servants who *mislead* or misinform you. *Bacon.*

Poor *misled* men: your states are yet worthy pity.
If you would hear, and change your savage minds,
Leave to be mad. *Ben Jonson's Catiline.*

O thievish night,
Why shouldest thou but for some felonious end,
In thy dark lanthorn thus close up the stars,
That nature hung in heaven, and filled their lamps
With everlasting oil, to give due light
To the *misled* and lonely traveller? *Milton.*

What can they teach and not *mislead*;
Ignorant of themselves, of God much more? *Id.*

The imagination, which is of simple perception, doth never of itself, and directly *mislead* us; yet it is the almost fatal means of our deception. *Glanville's Scepsis.*

Thou who hast taught me to forgive the ill,
And recompense, as friends, the good *misled*;
If mercy be a precept of thy will,
Return that mercy on thy servant's head. *Dryden.*

Whatever necessity determines to the pursuit o. real bliss, the same necessity establishes suspense, and scrutiny of each successive desire, whether the satisfaction of it does not interfere with our true happiness, and *mislead* us from it. *Locke.*

'Tis hard to say, if greater want of skill
Appear in writing or in judging ill;
But of the two, less dangerous is the offence
To tire our patience, than *mislead* our sense. *Pope.*

MISLIKE', *v. a.* & *n. s.* } Mis and like. MISLI'KER, *n. s.* } To disapprove; dislike: disapprobation; distaste: a misliker is one that disapproves.

Open flatterers of great men, privy *mislikers* of good men, fair speakers with smiling countenances. *Ascham.*

Himself stood director over them, with nodding or stamping, showing he did like or *mislike* those things he did not understand. *Sidney.*

Setting your scorns and your *mislikes* aside,
Tell me some reason, why the lady Grey
Should not become my wife. *Shakspeare. Henry VI.*

Tertullian was not deceived in the place; but Aquinas, who *misliked* this opinion, followed a worse. *Raleigh.*

Their angry gestures with *mislike* disclose,
How much his speech offends their noble ears. *Fairfax.*

Judge not the preacher, for he is thy judge:
If thou *mislike* him, thou conceiv'st him not. *Herbert.*

We have religion enough to *mislike* pleasures; not to overcome them. But if we be once conquerors over ourselves, and have devoted ourselves wholly to God, there can be nothing but heavenly mirth to the soul. *Bp. Hall.*

MIS'LEN, *n. s.* From MISCELLANE, which see. Mixed corn: as, wheat and rye.

They commonly sow those lands with wheat, *mislen*, and barley. *Mortimer's Husbandry.*

MIS'LE, *v. n.* From MIST. To rain in imperceptible drops, like a thick mist: properly mistle.

Ynough thou mourned hast,
Now ginnes to *mizzle*, hie we homeward fast. *Spenser.*

The very small drops of a *misling* rain descending through a freezing air, do each of them shoot into one of those figured icicles. *Grew's Cosmologia.*

In *misling* days when I my thresher heard,
With happy beer I to the barn repaired. *Gay's Pastorals.*

This cold precipitates the vapours either in dews, or, if the vapours more copiously ascend, they are condensed into *misling*, or into showers of small rain, falling in numerous, thick, small drops. *Derham's Physico-Theology.*

MISLIVE', *v. n.* Mis and live. To live ill.

Should not thilke God, that gave him that good,
Eke cherish his child if in his ways he stood,
For if he *mislive* in lewdness and lust,
Little boots all the wealth and the trust. *Spenser.*

MISMAN'AGE, *v. a.* } Mis and manage. MISMAN'AGEMENT, *n. s.* } To manage ill: ill management or conduct

The debates of princes' councils would be in danger to be *mismanaged*, since those who have a great stroke in them are not always perfectly knowing in the forms of syllogism. *Locke.*

It is *mismanagement* more than want of abilities, that men have reason to complain of in those that differ. *Id.*

3 C 2

The falls of fav'rites, projects of the great,
Of old *mismanagement*, taxations new,
All neither wholly false, nor wholly true. *Pope.*

MISMARK', *v. a.* Mis and mark. To mark with a wrong token.

Things are *mismarked* in contemplation and life for want of application or integrity. *Collier.*

MISMATCH', *v. a.* Mis and match. To match unsuitably.

What at my years forsaken! had I
Ugly, or old, *mismatched* to my desires
My natural defects had taught me
To set me down contented. *Southern.*

MISNAME', *v. a.* Mis and name. To call by the wrong name.

They make one man's fancies, or perhaps failings, confining laws to others, and convey them as such to their succeeders, who are bold to *misname* all unobsequiousness to their incogitancy, presumption. *Boyle on Colours.*

A MISNOMER, in law, a misnaming or mistaking a person's name. The Christian name of a person should always be perfect; but the law is not so strict in regard to surnames, a small mistake in which will be dispensed with to make good a contract, and support the act of the party. See PLEA TO INDICTMENT.

MISO, a substance resembling salt butter, and used as a substitute for it by the Japanese, prepared from a plant called daidsu, a species of dolichos. To make it they take a measure of mame, or the beans produced by the plant; after boiling them for a considerable time in water, and to a proper degree of softness, they beat or bray them into a softish pulse, incorporating with the mass a large quantity of salt, four measures in summer and three in winter. The less salt that is added, the substance is more palatable; but what it gains in point of taste it loses in durability. They then add to this mixture a certain proportion of rice, called koos; and, having formed the whole into a compost, remove it into a wooden vessel which had lately contained their common ale, named sacki. In two months it is fit for use. The koos gives it a grateful taste; and the preparing of it, like the palenta of the Germans, requires the skilful hand of an experienced master. For this reason there are people who make it their sole business to prepare the koos, and who sell it ready made for making miso: a substance which cannot fail to be greatly valued in those countries where butter from the milk of animals is unknown.

MISOBSERVE', *v. a.* Mis and observe. Not to observe accurately.

They understand it as early as they do language; and, if I *misobserve* not, they love to be treated as rational creatures sooner than is imagined. *Locke.*

MISOR'DER, *v. a.* & *n. s.* } Mis and order.
MISOR'DERLY, *adj.* } To conduct ill: irregularity; disorderly proceedings: misorderly is irregular; unlawful.

If the child miss either in forgetting a word or *misordering* the sentence, I would not have the master frown. *Ascham.*

His over-much fearing of you drives him to seek some *misorderly* shift, to be helped by some other book, or to be prompted by some other scholar. *Ascham's Schoolmaster.*

The time *misordered* doth in common sense
Crowd us, and crush us to this monstrous form,
To hold our safety up. *Shakspeare. Henry IV.*

When news was brought to Richard the Second, that his uncles, who sought to reform the *misorders* of his counsellors, were assembled in a wood near unto the court, he merrily demanded of one Sir Hugh a Linne, who had been a good military man, but was then somewhat distraught of his wits, what he would advise him to do? Issue out, quoth Sir Hugh, and slay them every mother's son; and when thou hast so done thou hast killed all the faithful friends thou hast in England. *Camden.*

MISPEL', *v. a.* Mis and spell. To spell wrong.

She became a profest enemy to the arts and sciences, and scarce ever wrote a letter to him without wilfully *mispelling* his name. *Spectator.*

MISPEND', *v. a.* } Preterite and part. pas-
MISPEND'ER, *n. s.* } sive mispent. Mis and spend. To spend ill; waste; consume to no purpose: mispender, one who spends prodigally.

What a deal of cold business doth a man *mispend* the better part of life in! In scattering compliments, tendering visits, gathering and venting news. *Ben Jonson's Discovery.*

First guilty conscience doth the mirrour bring,
Then sharp remorse shoots out her angry sting;
And anxious thoughts, within themselves at strife,
Upbraid the long *mispent* luxurious life. *Dryden.*

Now let the arched knife their thirsty limbs
Dissever, for the genial moisture due
To apples, otherwise *mispends* itself
In barren twigs. *Phillips.*

I suspect the excellency of those men's parts who are dissolute, and careless *mispenders* of their time. *Norris.*

He who has lived with the greatest care will find, upon a review of his time, that he has something to redeem; but he who has *mispent* much has still a greater concern. *Rogers.*

I this writer's want of sense arraign,
Treat all his empty pages with disdain,
And think a grave reply *mispent* and vain. *Blackmore.*

Let him now endeavour to redeem what he hath *mispent* by employing more of that leisure in this duty for the future. *Duty of Man.*

O man! while in thy early years,
How prodigal of time!
Mispending all thy precious hours,
Thy glorious youthful prime! *Burns.*

MISPERSUA'SION, *n. s.* Mis and persuasion. Wrong notion; false opinion.

Some *mispersuasions* concerning the divine attributes tend to the corrupting men's manners. *Decay of Piety.*

MISPLACE', *v. a.* Mis and place. To put in a wrong place.

I'll have this crown of mine cut from my shoulders,
Before I'll see the crown so foul *misplaced*. *Shakspeare.*

What little arts govern the world! we need not
An armed enemy or corrupted friend,
When service but *misplaced*, or love mistaken,
Performs the work. *Denham's Sophy.*

Is a man betrayed by such agents as he employs? He *misplaced* his confidence, took hypocrisy for fidelity, and so relied upon the services of a pack of villains. *South.*

Shall we repine at a little *misplaced* charity, we who could no way foresee the effect? *Atterbury.*

MISPRISE', *v. a.* } Either from Fr. *mesprendre*, mistake, or *mepriser*, undervalue, disdain. To mistake, or slight; despise: the noun follows one or other of these senses; but both words are obsolete.
MISPRIS'ION, *n. s.* }

You spend your passion on a *misprised* mood;
I am not guilty of Lysander's blood. *Shakspeare.*

Pluck indignation on thy head;
By the *misprising* of a maid, too virtuous
For the contempt of empire. *Id.*

Thou hast mistaken quite,
And laid thy love-juice on some true love's sight;
Of thy *misprision* must perforce ensue
Some true love turned, and not a false turned true. *Id.*

To vindicate our religion from such *misprisions*, and that we may be engaged to prise and cherish it, I shall endeavour to declare that Christian faith doth worthily deserve all the commendations and the advantages granted thereto. *Barrow.*

We feel such or such a sentiment within us, and herein is no cheat or *misprision*; it is truly so, and our sense concludes nothing of its rise. *Glanville's Scepsis.*

MISPRISIONS, from the old French, mespris, a neglect or contempt, are, in the English law, generally understood to be all such high offences as are under the degree of capital, but nearly bordering thereon; and a misprision is contained in every treason and felony whatsoever; and, if the king please, the offender may be proceeded against for the misprision only. Upon this principle, while the jurisdiction of the star-chamber subsisted, it was held that the king might remit a prosecution for treason, and cause the delinquent to be censured in that court, merely for a high misdemeanor; as happened in the case of Roger, earl of Rutland, in 43 Eliz., who was concerned in the earl of Essex's rebellion. Misprisions are generally divided into two sorts, viz. negative, which consist in the concealment of something which ought to be revealed; and positive, which consist in the commission of something which ought not to be done.

MISPRISIONS, NEGATIVE, are either misprision of treason or of felony.

MISPRISION OF FELONY is the concealment of a felony which a man knows, but never assented to; for, if he assented, this makes him either principal or accessory. And the punishment of this, in a public officer, by stat. Westm. 1. 3 Ed. I. c. 9, is imprisonment for a year and a day: in a common person, imprisonment for a less discretionary time; and in both, fine and ransom at the king's pleasure; which pleasure of the king must be observed, once for all, not to signify any extrajudicial will of the sovereign, but such as is declared by his representatives, the judges in his courts of justice, voluntas regis in curia, non in camera.

MISPRISION OF TREASON consists in the bare knowledge and concealment of treason, without any degree of assent thereto: for any assent makes the party a principal traitor; as indeed the concealment, which was construed aiding and abetting, did at the common law; in like manner, as the knowledge of a plot against the state, and not revealing it, was a capital crime at Florence, and other states of Italy. But it is enacted, by stat. 1 and 2 P. & M. c. 10, that a bare concealment of treason shall be only held a misprision. This concealment becomes criminal if the party apprised of the treason does not, as soon as conveniently may be, reveal it to some judge of assize or justice of the peace. But if there be any probable circumstances of assent, as if one goes to a treasonable meeting, knowing beforehand that a conspiracy is intended against the king; or being in such company once by accident, and, having heard such treasonable conspiracy, meets the same company again, and hears more of it, but conceals it, this is an implied assent in law, and makes the concealer guilty of actual high treason.

MISPRISIONS, POSITIVE, are generally denominated contempt or high misdemeanors; of which the principal is the mal-administration of such high offices as are in public trust and employment. This is usually punished by the method of parliamentary impeachment; wherein such penalties, short of death, are inflicted, as to the wisdom of the house of peers shall seem proper; consisting usually of banishment, imprisonment, fines, or perpetual disability. Hither also may be referred the offence of embezzling the public money, called among the Romans peculatus; which the Julian law punished with death in a magistrate, and with deportation, or banishment, in a private person. In the English law it is not capital, but subjects the committer of it to a discretionary fine and imprisonment. Other misprisions are, in general, such contempts of the executive magistrate as demonstrate themselves by some arrogant and undutiful behaviour towards the king and government. For a detail of which see *Blackstone's Commentaries*, iv. 12.

MISPROUD', *adj.* Mis and proud. Viciously proud. Obsolete.

Now I fall thy touch commixtures melt,
Impairing Henry, strengthening *misproud* York. *Shakspeare.*

MISQUOTE', *v. a.* Mis and quote. To quote falsely.

Look how we can, or sad, or merrily,
Interpretation will *misquote* our looks. *Shakspeare.*

After all the care I have taken, there may be several passages *misquoted*. *Arbuthnot on Coins.*

MISRECITE', *v. a.* Mis and recite. To recite not according to the truth.

He *misrecites* the argument, and denies the consequence, which is clear. *Bramhall against Hobbes.*

MISREC'KON, *v. a.* Mis and reckon. To reckon wrong; to compute wrong.

Whoever finds a mistake in the sum total, must allow himself out, though after repeated trials he may not see in which article he has *misreckoned*. *Swift.*

MISRELATE', *v. a.* } Mis and relate. To relate inaccurately or falsely: false or inaccurate narrative.
MISRELA'TION, *n. s.* }

Mine aim was only to press home those things in writing, which had been agitated between us by word of mouth; a course much to be preferred before verbal conferences, as being less subject to mistakes and *misrelations*, and wherein paralogisms are more quickly detected. *Bramhall.*

To satisfy me that he *misrelated* not the experiment, he brought two or three small pipes of glass, which gave me the opportunity of trying it. *Boyle*

MISREMEM'BER, *v. n.* & *v. a.* Mis and remember. To mistake by trusting to memory.

If I much *misremember* not, I had such a spirit from peas kept long enough to lose their verdure. *Boyle.*

MISREPORT', *v. a.* & *n. s.* Mis and report. To give a false account of: false or malicious representation.

His doctrine was *misreported*, as though he had every where preached this not only concerning the Gentiles, but also touching the Jews. *Hooker.*

A man that never yet
Did, as he vouches, *misreport* your grace.
Shakspeare.

We defend him not,
Only desire to know his crime: 'tis possible
It may be some mistake or *misreport*,
Some false suggestion, or malicious scandal.
Denham.

The wrong judgment that misleads us, and makes the will often fasten on the worst side, lies in *misreporting* upon the various comparisons of these. *Locke.*

As by flattery a man is usually brought to open his bosom to his mortal enemy, so by detraction, and a slanderous *misreport* of persons, he is often brought to shut the same even to his best and truest friends. *South's Sermons.*

MISREPRESENT', *v. a.* } Mis and re-
MISREPRESENTA'TION, *n. s.* } present. To falsify, or represent to disadvantage: the act of misrepresenting.

The character of the scholars of the present age will not be much injured or *misrepresented* by saying that they seem to be superficially acquainted with a multitude of subjects, but go to the bottom of very few. *Adventurer.*

Since I have shewn him his foul mistakes and injurious *misrepresentations*, it will become him publicly to own and retract them. *Atterbury.*

Two qualities necessary to a reader before his judgment should be allowed, are common honesty and common sense; and that no man could have *misrepresented* that paragraph, unless he were utterly destitute of one or both. *Swift.*

MISRULE', *n. s.* Mis and rule. Tumult; confusion; revel; unjust domination.

In the portal placed, the heaven-born maid,
Enormous riot, and *misrule* surveyed. *Pope.*
And through his airy hall the loud *misrule*
Of driving tempest is for ever heard. *Thomson.*

MISS, *n. s.* Contracted from mistress: but there is a Belgic *meisje*, a little girl: the term of honor to a young girl; also a concubine; a loose woman.

All women would be of one piece,
The virtuous matron and the *miss*. *Hudibras.*
This gentle cock, for solace of his life,
Six *misses* had besides his lawful wife. *Dryden.*

Where there are little masters and *misses* in a house they are great impediments to the diversions of the servants. *Swift.*

It cannot reasonably be doubted, but a little *miss*, dressed in a new gown for a dancing-school ball, receives as complete enjoyment as the greatest orator who triumphs in the splendour of his eloquence, while he governs the passions and resolutions of a numerous assembly. *Hume.*

Even *misses*, at whose age their mothers wore
The backstring and the bib, assume the dress
Of womanhood, sit pupils in the school
Of card-devoted time, and night by night
Placed at some vacant corner of the board,
Learn every trick, and soon play all the game.
Cowper.

MISS, *v. a.*, *v. n.* & *n. s.* Sax. mιʃʃan; Teut. and Belg. *missen;* Goth. and Swed. *missa*. To go beside a mark; not to hit an object of any kind; omit; do without; perceive or feel the omission, or want of something: as a neuter verb to fly away from a mark or object; fail; mistake; be lost; miscarry: as a substantive (obsolete or only used in low language) omission; loss; want; mistake; hurt or harm.

Thy shepherds we hurt not, neither was there ought *missing* unto them. 1 *Sam.* xxv. 7.

In vain have I kept all that this fellow hath in the wilderness, so that nothing was *missed*.
1 *Sam.* xxv. 21.

Without him I found a weakness, and a mistrustfulness of myself, as one strayed from his best strength, when at any time I *missed* him. *Sidney.*

In humble dales is footing fast,
The trode is not so tickle,
And though one fall through heedless haste,
Yet is his *misse* not mickle. *Spenser's Pastorals.*

He did without any great *miss* in the hardest points of grammar. *Ascham's Schoolmaster.*

Grittus *missing* of the Moldavian fell upon Maylat.
Knolles.

So may I, blind fortune leading me,
Miss that, which one unworthier may attain;
And die with grieving.
Shakspeare. Merchant of Venice.

We cannot *miss* him; he does make our fire,
Fetch in our wood. *Id. Tempest.*

My lord,
Upon my lady's *missing*, came to me
With his sword drawn. *Id.—Cymbeline.*

I could have better spared a better man.
Oh, I should have a heavy *miss* of thee,
If I were much in love with vanity.
Shakspeare.

The general root of superstition is, that men observe when things hit, and not when they *miss:* and commit to memory the one, and forget and pass over the other. *Bacon.*

If I die, the world shall *miss* me but a little: I shall *miss* it less. Not it me, because it hath such store of better men: not I it, because it hath so much ill, and I shall have so much happiness.
Bp. Hall.

To heaven their prayers
Flew up, nor *missed* the way. *Milton.*

For a time caught up to God, as once
Moses was in the mount, and *missing* long,
And the great Thisbite, who on fiery wheels
Rode up to heaven, yet once again to come. *Id.*

The invention all admired, and each, how he
To be the inventor *missed*, so easy it seemed,
Once found, which yet unfound most would have thought
Impossible. *Id. Paradise Lost.*

Flying bullets now
To execute his rage, appear too slow,
They *miss* or sweep but common souls away.
Waller.

Where shall a maid's distracted heart find rest,
If she can *miss* it in her lover's breast? *Dryden.*

When a man *misses* his great end, happiness, he will acknowledge he judged not right. *Locke.*

If these papers have that evidence in them, there will be no great *miss* of those which are lost, and my reader may be satisfied without them. *Id.*

He who was a firm, sincere friend, may want all the rest without missing them. *South*

She would never *miss* one day,
A walk so fine, a sight so gay. *Prior.*

The moral and relative perfections of the Deity are easy to be understood by us; upon the least reflection we cannot *miss* of them. *Atterbury.*

He that is so tender of himself, that he can never find in his heart so much as to *miss* a meal, by way of punishment for his faults, shews he is not much fallen out with himself. *Duty of Man.*

The life you boasted to your javelin given,
Prince, you have *missed.* *Pope.*

The man who threatens the world is always ridiculous; for the world can easily go on without him, and, in a short time, will cease to *miss* him. *Johnson.*

The good we never *miss* we rarely prize. *Cowper.*

MIS'SAL, *n. s.* Fr. *missel;* Lat. *missale.* The mass book of the Romish church.

By the rubrick of the *missal,* in every solemn mass, the priest is to go up to the middle of the altar. *Stillingfleet.*

MISSAY', *v. n.* Mis and say. To speak ill of; censure. Obsolete.

Their ill behaviour garres men *missay,*
Both of their doctrine and their fay. *Spenser's Pastorals.*

We are not dwarfs, but of equal stature, if Vives *missay* not. *Hakewill on Providence.*

MISSEEM', *v. n.* Mis and seem. To make false appearance.

Foul Duessa meet,
Who with her witchcraft and *misseeming* sweet
Inveigled her to follow her desires unmeet. *Faerie Queene.*

Never knight I saw in such *misseeming* plight. *Id.*

MISSERVE', *v. a.* Mis and serve. To serve unfaithfully.

Great men, who *misserved* their country, were fined very highly. *Arbuthnot on Coins.*

MISSHAPE', *v. a.* } Part. misshapen and mis-
MISSHA'PEN, *adj.* } shaped. Mis and shape. To shape ill or badly: ill-shaped: in Shakspeare, perhaps, it only signifies ill directed: as, to shape a course.

Him then she does transform to monstrous hues,
And horribly *misshapes* with ugly sights,
Captived eternally in iron mews. *Faerie Queene.*

A rude *misshapen,* monstrous rabblement. *Id.*

His monstrous scalp down to his teeth it tore,
And that misformed shape, *misshaped* more. *Id.*

Let the *misshaped* trunk that bears this head
Be round impaled with a glorious crown. *Shakspeare.*

Thy wit, that ornament to shape and love,
Misshapen in the conduct of them both,
Like powder in a skill-less soldier's flask,
I set on fire. *Id. Romeo and Juliet.*

If the world will be so vain as to *misshape* itself, we may not be so foolish as to follow it. *Bp. Hall.*

Pluto hates his own *misshapen* race,
Her sister furies fly her hideous face. *Dryden.*

Pride will have a fall: the beautiful trees go all to the wreck here, and only the *misshapen* and despicable dwarf is left standing. *L'Estrange.*

They make bold to destroy ill-formed and *misshaped* productions. *Locke.*

The Alps broken into so many steps and precipices, form one of the most irregular, *misshapen* scenes in the world. *Addison.*

We ought not to believe that the banks of the ocean are really deformed, because they have not the form of a regular bulwark; nor that the mountains are *misshapen,* because they are not exact pyramids or cones. *Bentley's Sermons.*

Some figures monstrous and *misshaped* appear,
Considered singly, or beheld too near,
Which but proportioned to their site or place,
Due distance reconciles to form and grace. *Pope.*

MIS'SILE, *adj.* Lat. *missilis.* Thrown by the hand; striking at distance.

We bend the bow, or wing the *missile* dart. *Pope.*

MISSIO, in Roman antiquity, was a full discharge given to a soldier after twenty years service, and differed from the exauctoratio, which was a discharge from duty after seventeen years service. Every soldier had a right to claim his missio at the end of twenty years.

MIS'SION, *n. s.* } Lat. *missio;* Fr. *missio-*
MIS'SIONARY, } *naire, missive.* Errand or
MIS'SIONER, } message from a supreme
MIS'SIVE. } authority: persons, taken collectively, sent on such an errand: used by Shakspeare for faction; party: in an obsolete sense, discharge; dismission. A missionary or missioner is an individual so sent. See below. A missive, a letter or messenger.

Glorious deeds, in these fields of late,
Made emulous *missions* 'mongst the gods themselves,
And drove great Mars to faction. *Shakspeare.*

Rioting in Alexandria, you
Did pocket up my letters; and with taunts
Did gibe my *missive* out of audience. *Id.*

Great aids came in to him; partly upon *missives,* and partly voluntary from many parts. *Bacon.*

In Cæsar's army, somewhat the soldiers would have had, yet only demanded a *mission* or discharge, though with no intention it should be granted, but thought to wrench him to their other desires; whereupon with one cry they asked *mission.* *Id.*

In these ships there should be a *mission* of three of the brethren of Solomon's house, to give us knowledge of the sciences, manufactures, and inventions of all the world, and bring us books and patterns; and that the brethren should stay abroad till the new *mission.* *Id. New Atlantis.*

Her son tracing the desert wild,
All his great work to come before him set,
How to begin, how to accomplish best,
His end of being on earth, and *mission* high. *Milton.*

Like mighty *missioner* you come,
Ad partes infidelium. *Dryden.*

In vain with darts a distant war they try,
Short, and more short, the *missive* weapons fly *Id.*

The king grants a license under the great seal, called a congé d'elire, to elect the person he has nominated by his letters *missive.* *Ayliffe's Parergon.*

The divine authority of our *mission,* and the powers vested in us by the high-priest of our profession, Christ Jesus, are publickly disputed and denied. *Atterbury.*

You mention the presbyterian *missionary,* who hath been persecuted for his religion. *Swift.*

MISSION, MISSIO, among the Romans, a term used to signify the emperor's sending to rescue a wounded gladiator from his antagonist. The munerarii, or persons who exhibited the games, and likewise the people, were allowed to rescue a favorite gladiator. The manner of their sig-

nifying this favor was pollice presso, or with the thumb hid in the palm of the hand. However, the gladiator was only saved for that time; whereas by the rudis he had a free discharge.

MISSION, in theology, denotes a commission to preach the gospel. Jesus Christ gave his disciples their mission in these words, 'Go and teach all nations,' &c. The Romanists reproach the Protestants that their ministers have, strictly, no mission, as not being authorised in the exercise of their ministry, either by an uninterrupted succession from the apostles, or by miracles, or by any extraordinary proof of a vocation. Many among Protestants hold a similar doctrine as to episcopal succession and ordination; while others deny any other mission necessary for their ministry than the talent to discharge it.

MISSION is also used for an establishment of people zealous for the glory of God and the salvation of souls; who go and preach the gospel in remote countries. Among the Romanists, the religious orders of St. Dominic, St. Francis, St. Augustine, &c., &c., have missions in the Levant, America, &c. The Jesuits had likewise missions in China, and all other parts of the globe where they were able to penetrate. Protestant missions, for diffusing the light of Christianity through the benighted regions of Asia, America, and the South Seas, are numerous. An early undertaking of this kind was the Danish mission planned by Frederic IV. in 1706. See MISSIONARY.

MISSIONARY SOCIETIES. Under this article we need only notice that the zealous and laudable exertions of various bodies of Christians, who, within these few years, have associated for the purpose of propagating the gospel both at home and abroad, are detailed by us under the names adopted by the principal societies. The most pleasing success has of late attended their labors, and the system can need no defence in these pages.

But a writer whom we have already quoted on the prospects of the church (see our article MILLENNIUM), the Rev. E. Irving, has boldly questioned the entire claims of these societies to a scriptural or apostolical character. He accuses the modern missionary societies of 'patching and mending, helping and repairing, and accommodating the unchangeable constitution of the Messiah to the changeable constitution of the world.' He insists that what he calls the missionary charter is contained in Matt. x. 5–42; and that the ninth and tenth verses are still binding on modern missionaries. In his own peculiar manner he exclaims, 'I have been tempted to indignation and wrath, that the institution and appointment of the great Head of the church should have been so widely departed from in these modern times, and, being honestly and plainly stated, should find so little favor in the eyes of a generation which prideth itself in the evangelical character of its missionary undertakings. And that, instead of going about to seek men who were advanced in faith to the height of the undertaking, they have gone about to reduce the undertaking to the measure of an ordinary faith, and have attracted to the service many who were hardly fit for a pastoral care in the church at home, much less for laying the foundation of Christian empire abroad. But most of all hath a holy indignation risen within my breast, when, to keep up the popular glory and renown of their work, which they should be ever rectifying by the word of God, they should be content rather to obliterate and annul that part of his holy word which is able to give them counsel. It is instructive of the self-exaltation of man to hear with what cool indifference they would consign to uselessness those immortal counsels which our Lord gave for the conduct of Christian missionaries, in order that they may have the field open for their own infallibility. They would break through all rules and laws of interpretation, and, to a passage whose every word and sentence breathes immortality, they would give a temporary application, destroying its obligation, losing its comfort, and abolishing its promises to the evil-entreated messenger of peace: all because it contains in its bosom two clauses which were necessary to make it useful and applicable to the time which then was, as well as to the times which were to come. Against this I have argued by an analysis of the passage, against it I have protested by an appeal to the apostolical times, in the hope of being able to prevail by argument and appeal; though, I confess with slender hope in a time when names or periodical organs of opinion have obtained almost the whole authority in the church.'

These novel views of the subject have been already animadverted upon by Mr. Orme of Camberwell. He contends that the language of Christ must be interpreted of those whom alone it can concern. 'I hold as decidedly as you,' he says in his Expostulatory Letter to Mr. Irving, 'that all who can preach the gospel are bound to preach the gospel; that all who can heal the sick, and cast out devils, are obliged to do so; that all who can speak with tongues, or interpret tongues, are called to exercise their gifts. Show me the man who can convey himself 10,000 miles across the pathless ocean without purse or scrip, who does not need to be brought on his way, or whose necessities, when at a distance, require not to be relieved, and I will show the man on whom the commands of Christ, in their most literal interpretation, are as binding now as they were when first delivered.

'But this leads us to the consideration of the obligations upon all missionaries literally to comply with all the injunctions of this discourse; particularly with those contained in verses nine and ten. You admit that there are in the discourse two, and only two, restrictive clauses, or local and temporary directions. These relate to the limits of the first commission, and the exclusion of the Gentiles and Samaritans. If I do not succeed in proving that there are several other peculiar and temporary circumstances involved in this document, I shall willingly submit to any epithet which you may think proper to apply.

'The apostles themselves, then, when they first received their Lord's instructions, were restricted, both by the nature of the commission, and by their inability to execute it in a more enlarged acceptation. They fulfilled it however

to the extent of their ability, and this was all that was required of them; and is all that Christ expects of us.

'In the second place I hope you will admit, Sir, that the part of the chapter which relates to 'healing the sick, cleansing the lepers, raising the dead, casting out devils,' is temporary, if not local; binding only on those who possess the power. I am sure I need not dwell on this; yet it constitutes another grand peculiarity of this missionary charter, and shows that there are more parts of it than you acknowledge binding only on a particular class of individuals.

'The third exceptive clause is that which you admit limits the field of labor to the land of Israel; but which I contend includes also what was peculiar to that land, and to this particular period of the apostolic ministry.

'Before taking up another point, I must refer to a fourth limitation or peculiarity in this charge. It occurs in the ninteenth and twenty-first verses. 'But when they deliver you up, take no thought how or what ye shall speak; for it shall be given you in that same hour what ye shall speak: for it is not ye that speak, but the spirit of your father that speaketh in you.' Do you mean to contend for the literal adoption of these words by all Christian ministers and missionaries? You do, indeed, say, 'that the assurance that the Lord would put into their mouth what they should say, hath always been the fountain of their [Christ's confessors] eloquence.' And you affirm that 'this hath been the judgment of the whole church.' Excuse me, Sir, from thinking that this is either the faith of the church or your own. 'Take no thought,—settle it in your hearts not to meditate before' (Luke xxi. 14), is a positive prohibition of premeditation, either respecting the testimony or the defence of the gospel; most appropriate to divinely inspired men, but utterly unsuitable to others. Does the minister of Hatton Garden not premeditate before he addresses his orations to the people? Did he take no thought, when, like Cicero, 'he retired into the quiet and peaceful country, to prepare himself with every preparation of the mind and of the spirit,' in order to the production of 'For Missionaries after the Apostolical School, a Series of Orations?' Yet this is child's play compared with being brought before kings and governors for Christ's sake.

'You anticipate an objection to the literal adoption of the prohibition respecting provision drawn from Luke xxii. 35—38. 'And he said unto them, When I sent you without purse, and scrip, and shoes, lacked ye any thing? And they said, Nothing. Then he said unto them, But now, he that hath a purse, let him take it, and likewise his scrip; and he that hath no sword, let him sell his garment, and buy one. For I say unto you, that this that is written must yet be accomplished in me, And he was reckoned among the transgressors: for the things concerning me have an end. And they said, Lord, behold, here are two swords. And he said unto them, It is enough.'

'I do not wonder, Sir, that you have put forth all your strength on this passage, which, I feel confident, must prove the ruin of your whole theory. I shall not enter into your general explanation, farther than to say, I do not perceive the force of many of your reasonings. You contend against the literal application of the latter part of the passage. So do I. You do so because a literal adoption of the command would be at variance with scripture and common sense; so think I. You limit obedience to the injunction to a particular, and that a very short period, the hour of our Lord's darkness and desolation. This is adopting the very ground of your opponents respecting local and temporary obligations. And then you abandon the literal interpretation altogether, and contend for a figurative meaning. In the following passage you have surrendered your cause, and relieved any one from following you farther:—

'In all this there is nothing which hath or can have a wider application than to that hour of darkness, during which the glory of his kingdom was eclipsed. And, even of this season, that it was not to be literally interpreted is manifest from the scene which immediately took place. The disciples, mistaking his meaning, made answer to him in these words, 'Lord, here are two swords.' And he answered them, 'It is enough;' that is, it is enough that I have reduced your minds from these high and towering expectations of power, which would have cast you upon ruin, to the lowly sense of your weakness, and the prudent thought of your safety. But they, imagining that he really meant them to use these two swords with which they were provided, said, when the rout came upon him in the garden, 'Lord, shall we smite with the sword?' And Peter actually lifted up his sword, and smote the high priest's servant, and cut off his ear; to which action our Lord made the reply, 'Put up again thy sword into his place: for all they that take the sword shall perish by the sword.' Which shows that not only did he not intend the sentence under consideration to be understood of the propagation, but not even of the defence of his cause; that, so far from intending it to be applied literally to all times, he did not intend it to be literally applied even to that time of oppression, for the sake of which it was spoken. That it was to be understood, as we have explained it, for a strong and figurative way of reducing their minds from the ambitious thoughts of a power which their question indicated, down to a lowly sense of their true condition, its trials, and its dangers.'

We recommend the whole of this masterly letter to the consideration of such of our readers as feel interested in this important subject.

Missionary Society, Church. See Society, Church Missionary.

MISSISSIPPI, a river of the United States of North America, which rises from Ibasca Lake, long. 95° 8' W., lat. 47° 47' N., and, after a course of about 600 miles, reaches the falls of St. Anthony in lat. 44° N. It forms a junction with the Missouri in lat. 38° 50' N., and flows into the Gulf of Mexico by several mouths, the principal of which, called the Balize, is in long. 89° 30' W., lat. 29° 6' N.

This river overflows its banks every spring, and lays the country, for many miles in exten-

under water. It is from one to two miles in width, and of an uncommon depth. The navigation is difficult and dangerous. Vessels are from five to thirty days on their passage up to New Orleans; though, with a favorable wind, they will sometimes descend in twelve hours. From New Orleans to the Illinois the voyage requires eight or ten weeks. Boats of forty tons ascend to St. Anthony's Falls; but ships seldom ascend above Natchez. The navigation is now greatly facilitated by the use of steam-boats, the tonnage of six of which, some time since, exceeded 300, and one 400, tons. They are employed with great advantage, and their number is rapidly increasing. The principal towns on the Mississippi are New Orleans, Natchez, and St. Louis.

The whole length of the Mississippi is about 3000 miles. The length, above its junction with the Missouri, upwards of 1600 miles. The length of the Missouri, above the junction, is 3096 miles. The Missouri, being both longer and larger, may properly be considered the main river. On this principle the following table is constructed, exhibiting a view of the principal tributaries of this unrivalled stream. The first column expresses the distance of one junction from the preceding, the second the distance of the junction from the entrance into the Gulf of Mexico by the course of the stream, and the third the estimated length of the tributary river.

	Dist.	Whole Dist.	Length.
Red River		344	1500
Arkansaw	398	500	2170
White River	14	514	1200
Ohio	336	1092	1350
Mississippi	192	1284	1620
Osage	133	1417	600
Grand	107	1524	600
Kansas	100	1624	1200
Platte	260	1884	1800
Yellowstone	1280	3164	1100

BRANCHES OF THE TRIBUTARIES.

Branches of the Mississippi.

	Length.
Illinois	500
Moines	800
Of the Ohio.	
Tennessee	1100
Cumberland	750
Of Red River.	
Ouachitta	600
Of the Yellowstone.	
Bighorn	800

The above distances from the mouth of the Mississippi to the junction of the Missouri are given according to Mr. Darby. Some others make the distances greater. Above the junction the distances are given according to Lewis and Clark. Besides the above, there are a great number of other rivers, many of them large, that flow into the Mississippi and its tributaries.

The following table exhibits an estimate of the extent of country watered by this river and its branches. It comprises nearly three-fifths of the whole territory of the United States.

	Square Miles.
Missouri Territory, 2-3	1,000,000
Northwest Territory, ½	73,500
Illinois Territory, the whole	52,000
Indiana, 19-20	35,150
Ohio, 4-5	31,300
Pennsylvania, 1-3	14,600
New York, 1-100	460
Maryland, 1-100	120
Virginia, 2-5	25,600
North Carolina, 1-50	960
South Carolina, 1-150	190
Georgia, 1-100	620
Kentucky, the whole	42,000
Tennessee, the whole	40,000
Mississippi, 3-5	27,000
Louisiana, 2-3	32,000
Total,	1,375,500

Mississippi is one of the United States of North America, erected into a state in 1817; bounded north by Tennessee, east by Alabama Territory, south by the Gulf of Mexico and Louisiana, and west by Pearl and Mississippi Rivers, which separate it from the state of Louisiana. Long. 80° 30′ to 81° 35′ W., lat. 30° 10 to 35° N. 312 miles long from north to south, and 150 from east to west; containing about 45,000 square miles.

The Mississippi Territory was divided, in 1817, into two parts nearly equal; the western part forming the state of Mississippi, and the eastern forming the Alabama Territory. The population of the whole, in 1810, was 40,352; and, in 1830, 136,806, of whom 65,659 were slaves. The counties, population, and chief towns of the state of Mississipi, in 1816, are exhibited in the following table:—

Counties.	Pop.	Chief Towns.
Adams	12,129	Natchez
Amite	7,943	Liberty
Claiborne	9,818	Port Gibson
Franklin	4,622	Meadville
Greene	1,849	Leaksville
Hancock	1,961	Pearlington
Jefferson	9,755	Fayette
Lawrence	5,321	Monticello
Marion	3,701	Columbia
Pike	5,402	Holmesville
Warren	7,661	Warren
Wayne	2,778	Winchester
Wilkinson	11,693	Woodville
Washington	1,976	Princeton
Yaroo	6,550	Benton

These are the principal counties.

Monticello is the present seat of government. Natchez is the largest town, and Washington is next to Natchez in size. The other towns in the state are very small. A bank is established at Natchez with a capital of 3,000,000 dollars, having several branches. A college was incorporated, in 1802, at Washington, and another has been recently incorporated at Shieldsborough. There are academies at Natchez, Monticello, and Woodville.

The principal rivers are the Mississippi, Pearl, Pascagoula, Yazoo, Black, Tennessee, and the western branches of the Tombigbee. The Mississippi forms the western boundary from lat. 31° to 35° N.; 308 miles in a right line, but, by the course of the river, nearly 700 miles.

The southern part of the territory, extending about 100 miles north from the Gulf of Mexico, is mostly a champaign country, with occasional hills of moderate elevation, and is covered with forests of the long leaved pine, interspersed with cypress swamps, open prairies, and inundated marshes. A considerable portion of this part is susceptible of cultivation. The soil is generally sandy, sometimes gravelly and clayey. It is capable of producing cotton, corn, indigo, sugar, garden vegetables, plums, cherries, peaches, figs, sour oranges, and grapes. In proceeding north the face of the country becomes more elevated and agreeably diversified. The growth of timber consists of poplar, hickory, oak, black walnut, sugar-maple, buckeye, elm, hackberry, &c.; and the soil is exceedingly fertile, producing abundant crops of cotton, corn, sweet potatoes, indigo, garden vegetables, and fruit. Nearly all the country watered by the Yazoo is described as incomparably fertile, well-watered, and healthful.

Cotton is the staple production of the state. Tobacco and indigo have both been cultivated; but the former is nearly, and the latter entirely, abandoned by the planters. Peaches and figs are the fruits most easily produced. Apples, plums, lemons, and oranges, are common. The climate is temperate, and in the elevated parts generally healthy. The local situation of this state, the fertility of its soil, the temperature of its climate, and the value of its productions, will doubtless cause it to remain an important part of the union.

The Choctaw and Chickasaw Indians possess a large portion of the territory of this state, embracing the northern and eastern parts. The tracts possessed by these tribes comprise some of the finest parts of the state, abounding with extensive and beautiful prairies.

MISSON (Francis Maximilian), an eminent French lawyer, who distinguished himself by his pleadings before the parliament of Paris in favor of the reformers. He retired into England after the revocation of the edict of Nantz, and became a strenuous advocate of the Protestant religion. In 1687 and 1688 he travelled to Italy as governor to an English nobleman; in consequence of which he published, at the Hague, A New Voyage to Italy, 3 vols. 12mo.; which was translated into English with many additions. He published also the Sacred Theatre at Cevennes, or An Account of Prophecies and Miracles performed in that part of Languedoc; London, 1707; Observations and Remarks of a Traveller, 12mo., Hague. He died at London in 1721.

MISSOURI, a river of North America, which rises in the rocky mountains, and, uniting with the Mississippi, flows into the gulf of Mexico. The three head branches are Jefferson's, Madison's, and Gallatin's Rivers, which are navigable for some distance. The following table of distances is taken from Lewis and Clark's Travels; and the distance, from the junction with the Mississippi to the gulf of Mexico, from Schultz.

From the extreme point of navigation, in long. 111° 45′ W., lat. 43° 31′ N., to

	Miles.	Whole Dist.
The Gates of the Rocky Mountains	411	411
Great Falls	110	521
Yellowstone River . . .	695	1216
Fort Mandan	280	1496
Chyenne River	290	1786
Platte River	710	2496
Kansas River	260	2756
Grand River	100	2856
Osage River	107	2963
Mississippi River . . .	133	3096
Gulf of Mexico . . .	1395	4491

The only interruption of the navigation through this whole distance is at the Great Falls. At these falls the river descends, in the space of eighteen miles, 357 feet. The greatest cascade is eighty-seven feet perpendicular, and exhibits a view of singular beauty and grandeur. There is another pitch of forty-seven feet. About 100 miles below these falls there are natural walls of stone, in several places, on the banks of the river. They rise 200 or 300 feet high, nearly perpendicular, exhibit a most extraordinary and romantic appearance, and are regarded as a great curiosity. The place where the river makes its escape from the mountains, called the 'Gates of the Rocky Mountains,' presents an object of extraordinary curiosity. For the distance of five miles and three-quarters the rocks rise perpendicularly from the water's edge nearly 1200 feet. The river is here compressed to the width of 150 yards; and, for the first three miles, there is but one spot, and that of only a few yards, on which a man could stand between the water and the perpendicular ascent of the mountain. From the Mississippi to the Great Falls the Missouri is not difficult of navigation; but, above the falls, the navigation is considerably obstructed by rocks and rapid currents. The breadth of this river, at its junction with the Mississippi, is from half to three-quarters of a mile; its waters are very turbid and muddy. See MISSISSIPPI.

MISSOURI TERRITORY, a country belonging to the United States. In the most extended sense it includes all the country of Louisiana not comprised within the limits of the state of Louisiana. For its extent, boundaries, &c., see LOUISIANA.

If the western boundary of the state of Louisiana were continued due north to lat. 40° 30′ N., and a line extended thence due east to the Mississippi, these limits, with the Mississippi on the east, and the state of Louisiana on the south, would include all the settlements made in the Missouri Territory, except on the Missouri and Mississippi rivers. The number of square miles in this region is about 98,000, of which 16,000 lie north, and 82,000 south, of the Missouri. The extended line on the western side would cross the Missouri fifteen or twenty miles below the mouth of the Kansas.

In 1810 this territory was divided into five districts, and contained 20,895 inhabitants, of whom 3618 were blacks.

In 1830 it comprised 33 counties, the principal of which, with their chief towns, are exhibited in the following table.

Counties.	Chief Towns.
Boon	Columbia
Cape Girardeau	Jackson
Howard	Fayette
Lincoln	Troy
New Madrid	New Madrid
St. Charles	St. Charles
St. Genevieve	St. Genevieve
St. Louis	St. Louis
Washington	Potosi
Wayne	Greenville.

The present population is estimated at about 140,074. St. Louis is the chief town. The other most considerable towns are St. Charles, St. Genevieve, Jackson, and Franklin. There are two banks at St. Louis. The principal rivers are the Mississippi, Missouri, Osage, Grand, Charlatan, Marameck, St. Francis, White, Arkansaw, and Ouachitta.

There are extensive alluvial tracts on all the rivers. This land, where it is not subject to inundation, is of excellent quality. Howard county, sometimes called Boone's Lick, which lies on both sides of the Missouri, extending south as far as Osage River, is represented as including some of the most fertile tracts in America. The land produces abundant crops of wheat, Indian corn, rye, oats, barley, potatoes, white clover, timothy, and blue grass. Various kinds of garden vegetables and fruits are cultivated. The forest trees are walnut, hickory, various kinds of oak, locust, ash, cotton-wood, pawpaw, coffee nut, sycamore, elm, maple, hackberry, box, &c. The climate is very pleasant and healthy.

The land in this territory on the Arkansaw is mostly alluvial, and, where not liable to inundation, excellent. The region watered by White River has immense strata of limestone and marble, and a great portion of it is of a very productive soil. Here are some prairies, but they are not very fertile or extensive. The country watered by the St. Francis is less fertile than that watered by White River. The country between these two rivers, for more than 100 miles above their junction, is overflowed; as is also the country between the St. Francis and the Mississippi. The southern part of the territory is well adapted to the culture of cotton, and some cotton is raised for domestic use north of Osage River.

This territory has an abundance of salt springs, from which salt is manufactured. It also has coal, iron, and lead mines. The famous lead mines of this country include a district about fifty miles in length, and twenty-five in breadth; the whole of which abounds in lead ore, so exceedingly rich that 100 lbs. of the ore will yield eighty or ninety of fine lead. The mines are so extensive that it is supposed that lead enough might be obtained from them to supply the world. They are forty-five miles west of Herculaneum, which is the present store-house of the mines.

Missouri, Little, a river of Louisiana, which runs into the Missouri 1690 miles from the Mississippi. Length about 500 miles.

MISSPEAK, *v. a.* & *v. n.* Mis and speak. To speak wrong; blunder in speech.

> It is not so; thou hast *mispoke*, misheard,
> Tell o'er thy tale again. *Shakspeare. King Lear.*
> A mother delights to hear
> Her early child *misspeak* half-uttered words.
> *Donne.*

MISSUS, in the Circensian games, were the matches in horse or chariot races. The usual number of missus or matches in one day was twenty-four; though Domitian presented the people with 100. The last match was generally made at the expense of the people, who made a collection for the purpose; hence it was called, Missus Ærarius, a subscription plate.

MIST, *n. s.* & *v. a.*, Mis'tiness, *n. s.*, Mis'ty, *adj.* } Sax. mirt; Belg. and Teut. *mist*. Vapor; a low thin cloud; small thin rain: hence metaphorically any thing that bedims or darkens: Shakspeare uses it as a verb for to cover with a cloud or vapor: misty is cloudy; vapory.

> The morrow fair with purple beams
> Dispersed the shadows of the *misty* night.
> *Faerie Queene.*

> Loud howling wolves arouse the jades,
> That drag the tragick melancholy night;
> Who with their drowsy, slow, and flagging wings
> Clip dead men's graves, and from their *misty* jaws
> Breathe foul contagious darkness in the air.
> *Shakspeare.*

> Good Romeo, hide thyself,
> —Not I, unless the breath of heart-sick groans
> *Mistlike* infold me from the search of eyes. *Id.*

> Lend me a looking-glass;
> If that her breath will *mist* or stain the stone,
> Why then she lives. *Id. King Lear.*

The speedy depredation of air upon watery moisture, and version of the same into air, appeareth in the sudden vanishing of vapours from glass, or the blade of a sword, such as doth not at all detain or imbibe the moisture, for the *mistiness* scattereth immediately. *Bacon.*

Parents overprize their children, while they behold them through the vapours of affection, which alter the appearance, as things seem bigger in *misty* mornings. *Wotton.*

My people's eyes once blinded with such *mists* of suspicion, they are misled into the most desperate actions. *King Charles.*

> Old Chaucer, like the morning star,
> To us discovers day from far;
> His light those *mists* and clouds dissolved
> Which our dark nation long involved.
> *Denham.*

> And *mists* condensed to clouds obscure the sky,
> And clouds dissolved the thirsty ground supply.
> *Roscommon.*

> His passion cast a *mist* before his sense,
> And either made or magnified the offence.
> *Dryden.*

A cloud is nothing but a *mist* flying high in the air, as a *mist* is nothing but a cloud here below. *Locke.*

As a *mist* is a multitude of small but solid globules, which therefore descend; so a vapour, and therefore a watery cloud, is nothing else but a congeries of very small and concave globules, which therefore ascend to that height in which they are of equal weight with the air, where they remain suspended, till by some motion in the air, being broken,

they descend in solid drops; either small, as in a *mist*, or bigger, when many of them run together, as in rain. *Grew.*

Now smoaks with showers the *misty* mountain ground,
And floated fields lie undistinguished round. *Pope.*

Are *mists* begotten? who their Father knew?
From whom descend the pearly drops of dew? *Young.*

All in this mottie, *misty* clime,
I backward mused on wasted time,
How I had spent my youthfu' prime,
An' done nae-thing. *Burns.*

MISTAKE', *v. a., v. n. & n. s.* } Mis and take. To take or conceive wrongfully; err: mistake is also put for the misconception or error made: mistakable, is liable to be misconceived: mistakingly, erroneously; foolishly or falsely.
MISTA'KABLE, *adj.*
MISTA'KINGLY, *adv.*

The towns, neither of the one side nor the other, willingly opening their gates to strangers, nor strangers willingly entering for fear of being *mistaken*. *Sidney.*

This dagger hath *mistaken*, for lo! the sheath
Lies empty on the back of Montague,
The point missheathed in my daughter's bosom. *Shakspeare.*

England is so idly kinged:
—You are too much *mistaken* in this king:
Question, your grace, the late ambassadors,
How modest in exception, and withal
How terrible in constant resolution. *Id.*

Seeing God found folly in his angels; men's judgments, which inhabit these houses of clay, cannot be without their *mistakings*. *Raleigh.*

The most general enmities and oppositions to good arise from *mistakings*. *Bp. Hall.*

He never shall find out fit mate; but such
As some misfortune brings him, or *mistake*. *Milton.*

Look, nymphs, and shepherds, look,
What sudden blaze of majesty,
Too divine to be *mistook*. *Id.*

It is not strange to see the difference of a third part in so large an account, if we consider how differently they are set forth in minor and less *mistakeable* numbers. *Browne.*

Mistaken Brutus thought to break their yoke,
But cut the bond of union with that stroke. *Waller.*

The error is not in the eye, but in the estimative faculty, which *mistakingly* concludes that colour to belong to the wall which does indeed belong to the object. *Boyle on Colours.*

Infallibility is an absolute security of the understanding from all possibility of *mistake* in what it believes. *Tillotson.*

These did apprehend a great affinity between their invocation of saints and the heathen idolatry, or else there was no danger one should be *mistaken* for the other. *Stillingfleet.*

This will make the reader very much *mistake* and misunderstand his meaning. *Locke.*

Fancy passes for knowledge, and what is prettily said is *mistaken* for solid. *Id.*

Those terrors are not to be charged upon religion, which proceed either from the want of religion, or superstitious *mistakes* about it. *Bentley.*

Fools into the notion fall,
That vice or virtue there is none at all:
Ask your own heart, and nothing is so plain
'Tis to *mistake* them costs the time and pain. *Pope.*

Servants *mistake*, and sometimes occasion misunderstanding among friends. *Swift.*

There are few, very few, that will own themselves in a *mistake*, though all the world see them to be in downright nonsense. *Id.*

Where men are the most sure and arrogant, they are commonly the most *mistaken*, and have there given reins to passion, without that proper deliberation and suspense, which can alone secure them from the grossest absurdities. *Hume.*

MISTAKEN POINT, a point on the west of Cape Race and east of Cape Pini, at the south-east point of the island of Newfoundland.

MISTATE', *v. a.* Mis and state. To state wrongly.

They *mistate* the question, when they talk of pressing ceremonies. *Bp. Saunderson.*

MISTEACH', *v. a.* Mis and teach. To teach wrong, or wrongly.

Such guides shall be set over the several congregations as will be sure to *misteach* them. *Saunderson.*

The extravagancies of the lewdest life are the more consummate disorders of a *mistaught* or neglected youth. *L'Estrange.*

MISTEM'PER, *v. a.* Mis and temper. To temper ill; to disorder.

This inundation of *mistempered* humour
Rests by you only to be qualified. *Shakspeare.*

MIS'TER, *adj.* Fr. *mestier*, trade. What mister means what kind of. Johnson. Obsolete.

The redcross knight toward him crossed fast,
To weet what *mister* wight was so dismayed,
There him he finds all senseless and aghast. *Spenser.*

MISTERM', *v. a.* Mis and term. To term erroneously.

Hence banished, is banished from the world;
And world exiled is death. That banished
Is death *mistermed*. *Shakspeare. Romeo and Juliet.*

MISTHINK', *v. a.* Mis and think. To think ill; to think wrong.

How will the country, for these woful chances,
Misthink the king, and not be satisfied! *Shakspeare.*

We, the greatest, are *misthought*
For things that others do. *Id. Anthony and Cleopatra.*

Thoughts! which how found they harbour in thy breast,
Adam! *Misthought* of her to thee so dear! *Milton.*

MIS'TION, *n. s.* Lat. *mistus*. The state of being mingled.

In animals many actions are mixt, and depend upon their living form as well as that of *mistion*, and though they wholly seem to retain unto the body, depart upon disunion. *Browne.*

Both bodies do, by the new texture resulting from their *mistion*, produce colour. *Boyle on Colours.*

MISTLETOE, *n. s.* Sax. mıꞅtelꞇan; Belg. *mistel*, bird-lime, and ꞇan, a twig. A plant. See below.

If snowe do continue, sheepe hardly that fare
Crave *mistle* and ivie for them for to spare. *Tusser.*

A barren and detested vale, you see it is:
The trees, though Summer, yet forlorn and lean,
Overcome with moss, and baleful *misseltoe*. *Shakspeare.*

Misseltoe groweth chiefly upon crab trees, apple trees, sometimes upon hazles, and rarely upon oaks; the *misseltoe* whereof is counted very medicinal: it is ever green Winter and Summer, and beareth a white

glistering berry; and it is a plant utterly differing from the plant upon which it groweth. *Bacon.*

All your temples strow
With laurel green, and sacred *misletoe.* *Gay.*

MISTLETOE. See VISCUM. The flower of the mistletoe consists of one leaf, which is shaped like a basin, divided into four parts, and beset with warts; the ovary, which is produced in the female flowers, is placed in a remote part of the plant from the male flowers, and consists of four shorter leaves; this becomes a round berry full of a glutinous substance, enclosing a plain heart-shaped seed. This plant is always produced from seed, and is not to be cultivated in the earth, but will always grow upon trees; whence the ancients, who thought it to be an excrescence on the tree without seed, accounted it a superplant. The manner of its propagation is said to be as follows: the misletoe thrush, which feeds upon the berries of this plant in winter, when they are ripe, opens the seed from tree to tree; for the viscous part of the berry, which immediately surrounds the seed, sometimes fastens it to the outward part of the bird's beak, which to get disengaged of, he strikes his beak at the branches of a neighbouring tree, and leaves the seed sticking by this viscous matter to the bark, which, if it lights upon a smooth part of the tree, will fasten itself, and the following winter put out and grow: the trees on which this plant grows most readily are the apple, the ash, and some other smooth rind trees.

MIS'TRESS, *n. s.* Fr. *maistresse.* The feminine of master; a woman who possesses, governs, or is skilled in something: a contemptuous cognomen; a concubine.

There had she enjoyed herself while she was *mistress* of herself, and had no other thoughts but such as might arise out of quiet senses. *Sidney.*

Here stood he in the dark, his sharp sword out,
Mumbling of wicked charms, conjuring the moon
To stand 's auspicious *mistress.*
Shakspeare. King Lear.

Let us prepare
Some welcome for the *mistress* of the house.
Shakspeare.

He'll make your Paris Louvre shake for it,
Were it the *mistress* court of mighty Europe. *Id.*

I will not charm my tongue; I'm bound to speak;
My *mistress* here lies murthered in her bed.
Id. Othello.

Look you pale, *mistress,*
Do you perceive the ghastness of her eyes?
Shakspeare.

Rome now is *mistress* of the whole world, sea, and land, to either pole. *Ben Jonson's Catiline.*

They would not suffer the prince to confer with, or very rarely to see, his *mistress,* whom they pretended he should forthwith marry. *Clarendon.*

Wonder not, sovereign *mistress!* if perhaps
Thou can'st, who art sole wonder; much less arm
Thy looks, the heaven of mildness, with disdain.
Milton.

This is indeed the highest philosophy; the true culture and medicine of our soul; the true guide of life, and *mistress* of action; the mother of all virtues. *Barrow.*

Ages to come, that shall your bounty hear,
Will think you *mistress* of the Indies were;
Though straiter bounds your fortune did confine,
In your large heart was found a wealthy mine.
Waller.

A letter desires all young wives to make themselves *mistresses* of Wingate's Arithmetic. *Addison.*

Those who assert the lunar orb presides
O'er humid bodies, and the ocean guides;
Whose waves obsequious ebb, or swelling run
With the declining or increasing moon;
With reason seem her empire to maintain
As *mistress* of the rivers and the main.
Blackmore.

What a miserable spectacle, for a nation that had been *mistress* at sea so long! *Arbuthnot on Coins.*

Nice honour still engages to requite
False *mistresses* and proud with slight for slight.
Granville.

Erect public schools, provided with the best and ablest masters and *mistresses.* *Swift.*

Fame is a public *mistress* none enjoys
But, more or less, his rivals' peace destroys;
With fame, in just proportion, envy grows;
The man that makes a character makes foes.
Young.

Sweet Poll! his doting *mistress* cries,
Sweet Poll! the mimic bird replies,
And calls aloud for sack. *Cowper.*

MISTRETTA, a large inland town of Sicily, in the Val di Demona, situated on a small river, about five miles from the great road from Palermo to Messina. Population 6000. Fifty miles east by south of Palermo.

MISTRUST', *n. s.* & *v. a.*
MISTRUST'FUL, *n. s.*
MISTRUST'FULNESS, *n. s.*
MISTRUST'FULLY, *adv.*
MISTRUST'LESS, *adj.*
} Mis and trust. Suspicion; want of confidence; diffidence: to mistrust is to doubt; suspect; disbelieve: the other derivatives follow these senses.

Without him I found a weakness, and a *mistrustfulness* of myself, as one strayed from his best strength, when at any time I missed him. *Sidney.*

Will any man allege those human infirmities, as reasons why these things should be *mistrusted* or doubted of? *Hooker.*

He needs not our *mistrust,* since he delivers
Our offices, and what we have to do,
To the direction just. *Shakspeare. Macbeth.*

By a divine instinct, men's minds *mistrust*
Ensuing danger; as by proof we see,
The waters swell before a boisterous storm.
Shakspeare

I hold it cowardice
To rest *mistrustful,* where a noble heart
Hath pawned an open hand in sign of love. *Id.*

Where he doth in stream *mistrustless* play,
Veiled with night's robe, they stalk the shore abroad.
Carew.

How shall I depend on him, for raising my body from dust, and saving my soul, if I *mistrust* him for a crust of bread towards my preservation?
Bp. Hall.

Fate her own book *mistrusted* at the sight,
On that side war, on this a single fight. *Cowley.*

Not then *mistrust,* but tender love, injoins
That I should mind thee oft; and mind thou me!
Milton.

The relation of a Spartan youth, that suffered a fox concealed under his robe to tear out his bowels, is *mistrusted* by men of business. *Browne.*

Here the *mistrustful* fowl no harm suspects,
So safe are all things which our king protects.
Waller.

The generous train complies,
Nor fraud *mistrusts* in virtue's fair disguise.
Pope.

How aften didst thou pledge and vow,
Thou wad for aye be mine!
And my fond heart, itsel sae true,
It ne'er *mistrusted* thine. *Burns.*

MISUND'ERSTAND, *v. a.* } Mis and understand. To mistake; misinterpret; misconceive; difference of understanding: dissension; disagreement.
MISUND'ERSTANDING, *n. s.* }

The words of Tertullian, as they are by them alledged, are *misunderstood.* *Hooker.*

He failed in distinguishing two regions, both called Eden, and altogether *misunderstood* two of the four rivers. *Raleigh.*

Sever the construction of the injury from the point of contempt, imputing it to *misunderstanding* or fear. *Bacon.*

There is a great *misunderstanding* betwixt the corpuscular philosophers and the chemists. *Boyle.*

This, if it be neglected, will make the reader very much mistake and *misunderstand* his meaning. *Locke.*

In vain do men take sanctuary in such *misunderstood* expressions as these; and, from a false persuasion that they cannot reform their lives, never go about it. *South.*

Were they only designed to instruct the three succeeding generations, they are in no danger of being *misunderstood.* *Addison.*

The example of a good man is the best direction we can follow in the performance of our duty; the most exact rules and precepts are subject to be *misunderstood*; some at least will mistake their meaning. *Rogers's Sermons.*

Servants mistake, and sometimes occasion *misunderstandings* among friends. *Swift.*

MISUSE', *v. a.* } Fr. *mesuser*, mis and use. To treat or use improperly; to abuse: misusage is ill usage; bad treatment.
MISU'SAGE, *n. s.* }

You *misuse* the reverence of your place,
As a false favorite doth his prince's name
In deeds dishonourable. *Shakspeare. Henry IV.*

Upon whose dead corpse there was such *misuse*,
Such beastly, shameless transformation,
By those Welshwomen done, as may not be
Without much shame retold. *Shakspeare.*

It hath been their custom shamefully to *misuse* the fervent zeal of men to religious arms, by converting the monies that have been levied for such wars to their own services. *Raleigh.*

Bacchus, that first from out the purple grape
Crushed the sweet poison of *misused* wine. *Milton.*

How names taken for things mislead the understanding, the attentive reading of philosophical writers would discover, and that in words little suspected of any such *misuse.* *Locke.*

Machiavel makes it appear, that the weakness of Italy, once so strong, was caused by the corrupt practices of the papacy, in depraving and *misusing* religion. *South.*

We have reason to humble ourselves before God by fasting and prayer, lest he should punish the *misuse* of our mercies, by stopping the course of them. *Atterbury.*

MISWEEN', *v. n.* Mis and ween. To misjudge; to distrust. Obsolete.

Latter times things more unknown shall show,
Why then should witless man so much *misween*?
Faerie Queene.

MISWEND', *v. n.* Mis and Sax. penðan, to go. To go wrong. Obsolete.

Every thing begun with reason,
Will come by ready means unto his end:
But things miscounselled must needs *miswend.*
Hubberd.

In this maze still wandered and *miswent*,
For heaven decreed to conceal the same,
To make the miscreant more to feel his shame.
Fairfax

MI'SY, *n. s.* Gr. μισυ. A kind of mineral.

Misy contains no vitriol but that of iron: it is a very beautiful mineral, of a fine bright yellow colour, of friable structure, and resembles the golden marcasites. *Hill.*

MITCHELSTOWN, a post town of Ireland, in the county of Cork, 102 miles from Dublin. It has a college for the support of twelve decayed gentlemen and twelve gentlewomen, who have £40 yearly, with handsome apartments, and a chaplain at £100 a year, with a house. Divine service is daily performed in a neat chapel belonging to the college: the whole was founded by the late earl of Kingston. Here is also a most magnificent seat of lord Kingsborough. Near this town, at the foot of one of the Galtee mountains, is the cave of Skeheenrinky, which is described by Arthur Young in his Irish Tour, and preferred by him to the famous cave in the peak of Derbyshire, as it was by lord Kingsborough to the Grot d'Aucel in Burgundy. Fairs are held on the 30th July and 12th November.

MITE, *n. s.* Fr. *mite*; Belg. *migt*, *myte*; Teut. *meit*, *macte*; all, perhaps, of Goth. *mith*, minute. A small insect; small coin or particle; any thing very small.

And he saw a certain poor widow casting in thither two mites: and he said, Of a truth I say unto you, that this poor widow hath cast in more than they all. *Luke* xxi. 43.

Through any man's corn they do bite,
They will not allow him a *mite.* *Tusser.*

Virginity breeds *mites*, like a cheese consumes itself to the very paring, and dies with feeding its own stomach. *Shakspeare.*

Are you defrauded, when he feeds the poor?
Our *mite* decreases nothing of your store. *Dryden.*

The idea of two is as distinct from the idea of three, as the magnitude of the earth from that of a *mite.* *Locke.*

Put blue-bottles into an ant-hill, they will be stained with red, because the ants thrust in their stings, and instil into them a small *mite* of their stinging liquor, which hath the same effect as oil of vitriol. *Ray on the Creation.*

The polished glass, whose small convex
Enlarges to ten millions of degrees
The *mite* invisible else, of nature's hand
Least animal. *Philips.*

The Seville piece of eight contains thirteen penny weights twenty-one grains and fifteen *mites*, of which there are twenty in the grain, of sterling silver, and is in value forty-three English pence and eleven hundredths of a penny. *Arbuthnot.*

Did I e'er my *mite* with-hold
From the impotent and old? *Swift.*

MITE, in zoology. See ACARUS.

MITE, in Jewish antiquity, a small piece of money mentioned in Luke xii. 59, and xxi. 2. In the Greek it is Λεπτὸν, and is one half of the Κοδράντης, and therefore one-eighth of the Roman denarius, or of sevenpence-halfpenny of our money.

MITELLA, bastard American sanicle, a genus of the digynia order and decandria class of plants; natural order thirteenth, succulentæ: CAL. quinquefid: COR. pentapetalous, and inserted into the calyx; petals pinnatifid: CAPS. unilocular and bivalved, with the valves equal. There are four species, all natives of North America, rising with annual herbaceous stalks, from five or six to eight or nine inches, and producing spikes of small whitish flowers, whose petals are fringed on their edges. They are easily propagated, by parting their roots, in a shady situation and soft loamy soil.

MITHRA, or MITHRAS, a god of Persia and Chaldea, supposed to be the sun. He is generally represented as a young man, whose head is covered with a turban after the manner of the Persians. He supports his knee upon a bull that lies on the ground, and one of whose horns he holds in one hand, while with the other he plunges a dagger into his neck. The grand festival of Mithras was celebrated six days in the middle of the month of Mihir, which began September 30th and ended October 30th. On these days only was it lawful for the kings of Persia to get drunk and dance.

MITHRAS, FEASTS OF, in antiquity, feasts celebrated among the Romans in honor of Mithras. The most ancient instance of this worship among the Romans occurs in an inscription dated in the third consulate of Trajan, or about A. D. 101, on an altar thus inscribed, Deo Soli Mithræ. But the worship of Mithras was not known in Egypt and Syria in the time of Origen, who died about A. D. 263. The worship of Mithras was proscribed at Rome in 378 by order of Gracchus prefect of the prætorium. According to M. Freret, the feasts of Mithras were derived from Chaldea, where they had been instituted for celebrating the entrance of the sun into the sign Taurus.

MITH'RIDATE, *n. s.* Fr. *mithridate.*

Mithridate is one of the capital medicines of the shops, consisting of a great number of ingredients, and has its name from its inventor Mithridates, king of Pontus. *Quincy.*

But you of learning and religion,
And virtue, and such ingredients, have made
A *mithridate*, whose operation
Keeps off, or cures, what can be done or said.
Donne.

MITHRIDATE is a composition, in form of an electuary, supposed to serve either as a remedy or a preservative against poisons. See PHARMACY. It takes its name from the inventor, Mithridates VII. king of Pontus. The recipe was found in his cabinet, written with his own hand, and was carried to Rome by Pompey. It was translated into verse by Damocrates, a famous physician; and afterwards by Galen, from whom we have it; though it is supposed to have undergone considerable alterations since the time of its royal prescriber.

MITHRIDATE MUSTARD. See THLASPI.

END OF VOL. XIV.

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